Electronic “cordel”

Preservation and accessibility in the cordel literature

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Abstract

This study addresses the accessibility challenges inherent in the “cordel” literature, a culturally rich form of Brazilian poetry designated as national heritage. Traditional “cordel” leaflets, while culturally significant, present barriers to dissemination and preservation, particularly for print-disabled individuals. The study emphasizes the potential of digitization, as exemplified by the e-cordel project, to enhance accessibility. Despite its promising features, the current version of e-cordel exhibits limited accessibility features. The primary aim is to advance the e-cordel project by introducing new accessibility features and exploring the direct integration of accessibility into content through the EPUB3 format. Motivated by the need to address the cultural importance of “cordel” and its accessibility shortcomings, the study employs a design-based research methodology, focusing on real-world problem-solving and tool validation. Evaluation involves testing the system with a diverse population, prioritizing inclusivity, and utilizing questionnaires and interviews to assess the viability of the new format.

Keywords: Cordel, Accessibility, EPUB3, Print-disabled.

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Introduction

"Cordel" literature is a type of popular poetry written in verse and metered [1]. According to Haurélio [2], what would become the "cordel" arrived in Brazil aboard the first caravels. The origin of "cordel" dates to oral tradition, with roots in medieval Lusitanian troubadourism. The registration dossier [3] points out that the "cordel" literature is a cultural phenomenon linked to oral narratives of African, Indigenous, and European origin and linked to prose poetry brought by the Portuguese colonizers.

This literary genre, which is also a craft and means of survival for countless citizens of Brazil, won in 2018 the title of Brazilian Cultural Heritage by the National Institute of Historical and Artistic Heritage (IPHAN) [4], the Brazilian body responsible for implementing the safeguarding policy for intangible cultural heritage.

Being a Brazilian cultural heritage, two things become necessary: the protection/preservation of the heritage and access to it by the population. According to Decree 3551/00 [5], it is the responsibility of the Brazilian State to ensure the wide dissemination and promotion of registered cultural manifestations through safeguarding actions.

The National Guidelines for the Safeguarding of "cordel" literature [6] are mainly aimed at the promotion and wide dissemination of "cordel", including support for initiatives to insert it in schools and support for its circulation in various media.

The "cordel" literature is usually distributed in fragile leaflets, often printed on recycled paper, which can impact the dissemination of this literature since most access to the work is done physically. Which imposes the need to preserve historical work, for example.

Thus, in addition to the need to preserve the work, the fact that it exists almost exclusively in physical format makes it difficult for the population to access it. This problem is even more acute for historical works that cannot be handled by the public.

Visually impaired people encounter additional challenges, as traditionally, the "cordel" brochure does not include accessibility.

Some initiatives try to promote accessibility through the creation of audiobooks with narrated works [7] or even exhibitions where other resources are used, such as braille and guided tours [8].

The digitization of this type of material, as well as others, is essential for preserving memory and information already produced. The digitization of millions of books through initiatives such as Google Book Search and Microsoft Live Books has expanded our ability to search for and find information. Large-scale digitization projects have made it possible to access and preserve books [9].

Large-scale digitization focuses mainly on large collections and partnerships with libraries, in addition to requiring special equipment for the digitization of the collection. Such initiatives have minimal human intervention and typically do not go through a quality control process, although manual intervention is required for error correction to achieve near 100% accuracy. It has also been observed that the quality of the image and OCR produced by these initiatives does not comply with the good practices developed by librarians and archivists in recent years. The study [9] also mentions that the quality of the scanned material is inconsistent.

However, the digitization of a collection remains a powerful strategy for preservation and accessibility in a broad sense.

A study published in 2014 [10] states that “cordel” began to insert itself in the virtual space without losing its roots, adapting to the changes of time and fitting in with new technologies. According to the authors, this genre subsists because it modernized itself.

According to the same study [10], the computer and the internet gave a phenomenal boost to “cordel” literature and facilitated the dissemination and distribution of ideas.

This statement, however, is somewhat contradicted by the need to maintain the aesthetics and historical characteristics of the work. As seen in [3] some entities, such as the “Academia de Cordelistas do Crato”, inserted in their statute the obligation to maintain the process of typographic production of the leaflets, to keep the editorial characteristics of the early twentieth century, in a process of resistance to current printing technologies, aiming to preserve the "traditional" aesthetics of the leaflet.

Nevertheless, a digital format does not need to be a substitute for the traditional “cordel” leaflets but rather an ally in their preservation and dissemination.

Furthermore, an electronic format would facilitate the seamless incorporation of accessibility features into literary works. For instance, the EPUB 3 format explicitly includes accessibility features within its specifications, as seen in [11], [12].

An exemplary illustration of this concept is the e-cordel project, an open-source initiative created and maintained by the researcher of this study, with the primary objective of preserving and disseminating “cordel” literature through the Internet [13].

The project relies on the pre-existing digitization of “cordel” leaflets to establish a new way of access. The platform exclusively provides textual content for reading through a web interface and an Android application.

In addition to preserving the content of the work in a digital format, the e-cordel project may serve as a rudimentary alternative for individuals with visual impairments, as the text can be indexed by screen readers. Nevertheless, the current version of e-cordel exhibits certain limitations:

- The “cordel” loses its physical characteristics, such as page numbers, as the text is stored continuously.
- The platform is not available for authors, posing challenges to the inclusion of new works.
- Regarding reading functionality, there is a deficiency in usability features, such as the ability to resume reading from where the user left off.

This study investigates how to produce a digital version of “cordel” literature and tries to assess the impact of a new version from an accessibility perspective. The following sections cover the concepts behind accessible content, the methodology selected for the research, and the analysis of the results.

State of the art

Visual and print disabilities

Visual and print disabilities pose significant challenges to individuals' daily lives, affecting their ability to access information and engage with their surroundings. According to the World Report on Vision [14], at least 2.2 billion people have a vision impairment. It is important to note that the World Health Organization (WHO) defines vision impairment as any eye condition affecting the visual system and one or more vision functions. In this case, a person who wears contact lenses to compensate for their vision impairment still has a vision impairment.

According to WHO [14], tens of millions have a severe vision impairment. Vision impairment and blindness resulting from various major eye conditions are untreatable and necessitate rehabilitation. A diverse array of vision rehabilitation interventions exists, encompassing optical magnifiers, environmental modifications such as enhanced lighting, braille reading, screen readers, smartphone way finders, and so on.

People with visual impairments may not be able to access print materials like "cordel" literature. Other groups of individuals may also face difficulties. These people may be classified as print impaired.

A print impaired is someone who cannot use print due to a visual, physical, neurological, or perceptual disability [15]. The reasons for print disability may include dyslexia, visual impairments, or physical and mobility impairments [16].

These disabilities can create barriers to reading printed materials like "cordel" literature and participating fully in educational, professional, and social activities [15]. Opening a book, locating a particular entry, and reading that section of printed text can be challenging or even impossible [16].

Apart from this, it is also possible that some people with temporary or situational disabilities may face challenges interacting with printed materials. According to Gjøsaeter *et al.* [17] a situational disability is a temporary one that affects a person in a specific situation, such as a noisy sound background that can reduce hearing ability.

To understand these situational, temporary, and permanent disabilities, the table below, adapted from the study [17] was included. The table shows only disabilities relevant to the print and e-book context of this work.

	Permanent	Temporary	Situational
Touch	One arm	Arm Injury	New parent with a child on the arm
See	Blind	Cataract	Distract driver
Hear	Deaf	Ear infection	Bartender in a noisy bar

Table 1. The Persona spectrum with respect to permanent, temporary, and situational disabilities (based on Gjøsaeter et al. [17]).

If we consider the context aspect of disabilities, it means that accessible data is not only important for people with permanent disabilities. Garrish [12] states that everyone will benefit from accessible data at some point in their lives and that accessibility is critical for some people and universally beneficial for all.

Accessibility and electronic formats

The Cambridge Dictionary defines accessibility as “the quality of being able to be entered or used by everyone, including people who have a disability”, and “the quality of being easy to understand or enjoy”. If these definitions are applied to the content and not to a system, it is expected that accessible content can be used by everyone and be easy to understand.

Printed content does not hold these qualities for people with print disabilities. A blind person cannot “use” printed content, and a dyslexic person may not understand and enjoy it.

In discussions on accessibility, it's often mentioned that roughly 5 percent of books produced annually are accessible. While there's a trend of this number slightly increasing due to the growing production of ebooks, the overall availability of books in accessible formats remains quite limited [12].

As seen in the previous section, print-impaired persons may benefit from digital content, and advancements in digital technology offer promising solutions to mitigate challenges.

Nevertheless, Garrish [12] says that accessibility is a difficult concept to define, and there is no magic bullet solution that will make all content accessible to all people. One approach may not apply to all kinds of disabilities. Audio is essential for readers who are blind; however, individuals with dyslexia may benefit from audio, font adjustments, visual cues, or a blend of these features. There's no one-size-fits-all solution.

According to McNaught and Alexander [18], e-books, which are electronic versions of printed books, when formatted and constructed correctly, hold the potential to fulfill a broad spectrum of accessibility requirements, such as magnification with text reflow, color/contrast changes, text-to-speech support, alternative texts for images/tables, and compatibility with assistive technology devices.

The same requirements are necessary for “cordel” disabled readers, and this is why it is important to have a consistent publication of electronic versions.

However, there is a prevalent misconception that all data is accessible and that assistive technologies such as screen readers can effortlessly handle any content, but this is not true [12].

It can also be observed in the study [18] when the authors elaborate on the magnification of the text. It is stated that magnification alone is limited, and it may make navigation harder. It is important that the line lengths can reflow when text is magnified so that it still fits the screen.

That is, there are many formats for electronic publication, and it is important to select the one that can provide the most accessibility features. In this study, two different publication formats are analyzed: a web-based format, mainly HTTP (Hypertext Markup Language) and EPUB (Electronic Publication). The next sections review the accessibility aspect of each format.

Web-based format (HTTP)

According to Waddell et al [19] web accessibility ensures that people can access and use web content effectively. It involves designing web pages that accommodate individuals' needs and preferences, enabling interaction tailored to their requirements. While accessibility primarily focuses on providing access for people with disabilities, it also offers significant benefits to those without disabilities.

Nevertheless, accessibility goes beyond web content. Slatin [20] says that accessibility also encompasses the interaction between users and various tools like browsers, assistive technologies, and adaptive systems. The quality of this interaction depends on adherence to HTML specifications, accessibility guidelines, and user configurations. Assistive technologies such as screen readers and voice-based browsers play a crucial role, often relying on systems like Microsoft’s Active Accessibility to facilitate the transfer of information from applications to devices, enabling tailored user experiences.

Even though accessibility is not only web content, it is most of the time the only thing that a company or developer has control over. If we consider the e-cordel project, it is hard to imagine that it can influence or change underlying systems. The web content must be well-authored to allow users to get the most out of it.

For Waddell et al [19] accessibility focuses on ensuring that websites are perceivable, operable, and understandable. This is the goal that should be pursued. In other words, a web version of the “cordel” literature should be understandable.

To accomplish this, accessibility guidelines should be followed. Firth [21] states that there are groups that have been working to make the web more accessible. According to the author, these guidelines outline how sites can achieve a certain level of accessibility. Slatin [20] says that the Web Content Accessibility Guidelines (WCAG) are the most important single resource for web developers seeking to make sites accessible.

The Web Content Accessibility Guidelines (WCAG) were created through the W3C process in collaboration with individuals and organizations worldwide. Their goal is to establish a unified global standard for web content accessibility that addresses the needs of individuals, organizations, and governments alike [22].

The WCAG is a comprehensive list of requirements that, when applied, improve web accessibility. It has three levels, “A”, “AA”, and “AAA”. “A” is the easiest to achieve, and “AAA” is the most rigorous. “AA” is widely accepted as a legal standard [21].

The WCAG documents outline methods for enhancing the accessibility of web content for people with disabilities. "Web content" typically encompasses both natural information—such as text, images, and sounds—and the code or markup that defines its structure and presentation. At the time of writing this study, version three of the guidelines is still under development.

WCAG is primarily intended for web developers and other professionals who need or want a standard for web accessibility. According to the WCAG 2 Overview page [22], WCAG has 13 guidelines organized under four principles: perceivable, operable, understandable, and robust.

These principles lay the foundation for anyone to access and use web content. Perceivable means that the information being passed should not be invisible to all the users’ senses. Operable means that the interface must allow interaction in ways that users can perform. Understandable means that both the information provided and the operation of the user interface must be comprehensible. Finally, robust content means that it should be reliably interpreted by a wide range of user agents, including assistive technologies.

As technology evolves, the content should remain accessible, ensuring compatibility with future tools and devices [22].

If any of these principles are not upheld, users with disabilities may be unable to use the web effectively. Each principle is supported by specific guidelines and success criteria designed to address the needs of people with disabilities.

Firth [21] argues that even though WCAG is a good resource, there are a few issues. The first is the size of the guidelines that may get in the way of understanding and adopting accessibility since the guidelines are too dense to digest for many. Another problem is the fact that WCAG does not have to be followed before anyone put a site live. Added to the previous point, the author also mentioned that WCAG updates take too long to be published if compared to the pace technology evolves.

Having established the foundational principles of WCAG—Perceivable, Operable, Understandable, and Robust—it's important to explore how these principles are practically implemented in web development. One critical tool for achieving WCAG compliance, particularly in making dynamic and interactive web content accessible, is ARIA (Accessible Rich Internet Applications). ARIA enhances the accessibility of web components by bridging gaps where native HTML alone may fall short, ensuring users with disabilities can effectively interact with complex interfaces. By understanding how ARIA attributes complement WCAG guidelines, developers can create inclusive experiences that meet the needs of diverse users. Let’s dive into how ARIA works and its role in supporting WCAG compliance.

According to Firth [21], ARIA is a spec created by W3C to improve the accessibility of applications by providing extra information to screen readers. Aria roles provide screen reader users with more information and context. They are particularly useful for dynamic or interactive components, where standard HTML might not fully convey the context or functionality. ARIA attributes, like aria-label, aria-labelledby, and aria-describedby, help ensure that users with disabilities can interact effectively with complex interfaces.

Using ARIA aligns with the WCAG principles by making content more perceivable, operable, and understandable. For example, WCAG requires that all interface elements have accessible names or labels, and ARIA labels offer a practical solution for achieving this. However, it’s essential to use ARIA judiciously and only when native HTML elements or attributes are insufficient, as improper use can cause confusion or accessibility issues. The first rule of ARIA use [23] says that if there is a

native HTML element or attribute with the semantics and behavior required, it should be used instead of re-purposing an element and adding an ARIA role, state, or property.

Having reviewed the main points of web accessibility, it is now time to review accessibility in other formats of electronic publication since, besides a web version of "cordel" an EPUB version has also been created for the sake of the study. The EPUB 3 is a born-accessible format that was embraced by the publishing industry and used by Google, Pearson, and Apple Inc [24].

This is one of the main reasons EPUB 3 was selected for this study. In the next section, the EPUB 3 format and its main features will be presented.

EPUB 3

Garrish [11] states that e-book is just an abstract term used to refer to any electronic representation of a book, and includes formats such as PDF, HTML, ASCII text, Word, EPUB, and others. Among the existing formats, the EPUB was selected for this study due to its native accessibility features.

The EPUB name comes from a contraction of Electronic Publication. It is a format for electronic publication created by the International Digital Publishing Forum (IDPF) [11].

It is important to notice that EPUB is a general-purpose document format, and it can be used to create many kinds of publications and not only books [11].

The IDPF [25] defines the EPUB as "a distribution and interchange format standard for digital publications and documents. EPUB defines a means of representing, packaging, and encoding structured and semantically enhanced web content, including HTML5, CSS, SVG, images, and other resources, for distribution in a single-file format.".

EPUB combines different technologies, it includes four separate documents, or specifications, that explain how these technologies work together. This makes it easier for people to create EPUBs without needing to understand all the technical details. It also helps in making reading systems that can predictably handle EPUBs. That is, The EPUB standard not only defines the format for the content but also how reading systems render it [11].

EPUB is also made to be free and open for everyone to use, without any complicated legal restrictions. It would not make sense for a group promoting electronic

publishing worldwide, IDPF, to make its technology hard to access. EPUB is widely used because even simple text editing tools can create EPUBs [11].

The last EPUB version, the EPUB 3, was published on October 11, 2011, by the IDPF as a final Recommended Specification. In 2014, these specifications, except the changes document, were republished by the International Standards Organization as ISO/IEC TS 30135 parts 1-7. Each of these seven ISO specifications is identical to its IDPF equivalent [25], [26].

However, being recognized as a global standard entails more than simply adapting to the various writing styles and languages of diverse populations worldwide. In a significant step forward, the IDPF has integrated accessibility support directly into the new specification, rather than treating it as an afterthought. Consequently, this revision has resulted in significant enhancements across all key functional areas. Notably, there are improvements in integrated audio and video support, tighter integration of accessibility features into the specification, increased availability and integration of global language support mechanisms, and the introduction of richer expression options through publication-level metadata [11].

Because of this, the EPUB 3 is recommended by the Daisy Consortium, as the most direct way to comply with requirements to produce accessible documents [24].

The Daisy Consortium is a global consortium of organizations committed to developing global solutions for accessible publishing and reading. In its white paper [24], it is stated that by adopting born-accessible EPUB 3 for document creation, organizations can ensure compliance with the law and offer highly accessible documents to their readers.

A significant number of publishers, reading app vendors, developers, and technology firms are endorsing EPUB 3, which is experiencing a surge in demand and popularity. The study [24] indicates some useful features provided by the EPUB 3:

- Improved readability: EPUB 3's reflowable format adjusts seamlessly to different screen sizes and devices, including smartphones and tablets.
- Enhanced flexibility and adaptability: As individuals age, there's often a need for larger print sizes for comfortable reading. Each reflowable EPUB 3 document can easily switch to a large-print format with a simple click to increase font size. This flexibility and adaptability of the format is another.

- Streamlined navigation: EPUB 3 offers robust navigation capabilities through features like table of contents and direct page access, enhancing user experience.
- Enriched interactivity: EPUB 3 offers diverse interactive features, allowing for a more engaging reading experience.
- Addressing situational accessibility needs: EPUB 3 enables simultaneous reading and listening.

The first two features address some of the needs explored by McNaught and Alexander [18], who state that magnification alone may make it harder to navigate the page, so a reflowable format significantly improves the reading speed.

McNaught and Alexander [18] also state that the choice of file format significantly impacts accessibility. For instance, PDF documents that are essentially images of text cannot be read aloud, customized in color, or adjusted to fit larger font sizes. Similarly, Flash-based "flipbooks" may pose challenges or become inaccessible for individuals who require magnified reflowable text or text-to-speech functionality.

The tables below, extracted from Daisy Study [24], compare PDF and EPUB features required by different types of users such as blind readers, low-vision readers, and motor-impaired readers, as well as general accessibility features.

PDF	EPUB 3
The reading order needs to be tagged.	No post-production tagging is needed.
Running heads and footers are read out at the bottom of each page, often mid-sentence.	This is not an issue with EPUB. The screen reader experience is not interrupted in this way.
Text is plain text with no associated semantic markup unless tagged.	Semantics of text are provided, which helps comprehension when using TTS or Braille.
New user-interface keystrokes need to be learned to maximize the accessibility potential.	User interface-reading keystrokes are the same as for reading web documents.
Selecting and copying text with a screen reader is unreliable.	Selecting and copying text works well for students using screen readers.

Screen reader support varies across platforms.	Good screen reader support across major operating systems.
PDF offers bookmarks and the ability to navigate by headings.	Option to skip repetitive content and navigate by landmarks, headings, or other structures.

Table 2 - Comparison of Features of PDF & EPUB 3 Required by a Blind Reader. Based on [24].

One thing worth mentioning about the table above is that the semantics of the EPUB are game-changing for blind readers. In the Accessible EPUB 3 book [12], Garrish states that for individuals who rely on non-visual methods to navigate e-books, ensuring proper tagging of your data can significantly reduce many digital barriers. Meaningfully tagged data enables the ability to skip and navigate through structures seamlessly, without constantly referring to a table of contents. While sighted readers might not perceive any issues, convoluted structures within the markup can impede the reader's ability to follow the narrative flow effectively, causing frustration and hindering comprehension [12].

The table below shows the comparison of the formats for low-vision readers.

PDF	EPUB 3
Fonts are chosen by the designer.	Fonts can be personalized to the needs/preferences of the reader.
Spacing between letters, words & lines, and the size of the margins are fixed by the designer.	Spacing & margins can be personalized to the needs/preferences of the reader.
Very limited ability to customize colors.	EPUBs and e-book apps are built with reading in mind, so provide different display modes & some allow customization of many options.
Some readers have a read-aloud feature.	Many reading apps have a read-aloud feature with visual highlighting.
PDF will allow you to return to the page that was last seen if you return to that particular PDF.	Many reading systems/apps remember where you left off reading and return the reader to that location.

Table 3 - Comparison of Features of PDF & EPUB 3 Required by a Reader with Low Vision. Based on [24].

Table 3 also brings important findings that are supported by McNaught and Alexander [18]. The authors advocate in favor of customization to achieve higher levels of accessibility. They state that Individuals with certain visual impairments or dyslexia, particularly those with scotopic sensitivity, often find reading significantly easier when they can adjust text and background colors or contrasts. Additionally, this flexibility benefits individuals working in environments with extreme lighting conditions, whether very dark or very light.

The concerns towards individuals working in environments that make it harder to read is a clear example of situational disability and helps to understand the importance of accessibility to everyone.

The next table compares the formats with motor-impaired users in mind.

PDF	EPUB 3
Above a certain paper size and/or magnification levels, the page needs to be panned back and forth to read each line of text.	Scrolling behavior is an option to the reader's preference.

Table 4 - Comparison of Features of PDF & EPUB 3 Required by a Reader with Motor Impairment. Based on [24].

Table 4 shows another example of the advantage of text reflow provided by EPUB 3 but now applied to a different type of user that may face challenges when the interaction with the device is increased due to lack of accessibility.

Table 5 is more general accessibility features comparison but also brings important points to be taken into consideration.

PDF	EPUB 3
Wide range of reading apps, including many free ones.	Wide range of reading apps, including many free ones.
"Go to page" is supported, but only for page breaks. Going to the tenth page in a PDF is supported, but this is not necessarily page 10 in the publication.	"Go to page" is fully supported and is tied to the number printed in the publication.

Bookmarks are sometimes included or can be inferred to mimic a table of contents.	EPUB is built with ebooks in mind, so there is proper support for a table of contents in the standard and in reading apps.
Technical ability to embed multi-media files, but is not much used, and has limited options for accessibility.	Works well and supports many more options for accessibility with multi-media files.
Links to PDF will normally launch in a default viewer.	Links to an EPUB can be configured to open in an EPUB Reader (Windows requires installation of an EPUB Reader).
PDF does not have a document management system.	Most EPUB reading apps include a library/bookshelf function for managing documents.

Table 5 - Comparison of General Accessibility Features of PDF & EPUB 3. Based on [24].

Even though PDF content is more accessible than printed content, it is easy to notice that EPUB offers more features and advantages when accessibility needs to be guaranteed. The Daisy Study [24] encourages the widespread adoption of EPUB 3 either alongside or as a substitute for PDFs for government agencies and companies where publications are distributed to the public and utilized internally. It is also stated that the increased utilization of professor-produced EPUB 3 content would significantly enhance accessibility ratings for universities.

Methodology

The methodology selected for this study was the Design Science Research Methodology (DSRM) for Information Systems (IS), established by Peffers *et al* [27]. Design Research in IS involves a rigorous process of designing artifacts to solve observed problems, contribute to research, and communicate the results.

The study [27] introduces the DSRM, encompassing principles, practices, and necessary procedures for conducting such research. It achieves three main objectives: aligning with existing literature, offering a procedural model for conducting design science research, and providing a conceptual framework for presenting and assessing

such research in the field of Information Systems. The Design Science process comprises six steps: identifying and motivating the problem, establishing solution objectives, undertaking design and development, conducting demonstrations, evaluation, and communication.

It is noticed that the DSRM aligns well with the software engineering process, and it offers a framework to evaluate Information System studies. According to Peffers *et al* [27], engineering disciplines accept design as a valid research methodology because engineering research values incremental solutions. Broadly, this is exactly what is performed in this research.

According to De Villiers and Harpur [28] the DSRM methodology process was created based on the literature on design research and higher-level research in the field. The image below depicts the project's activities.

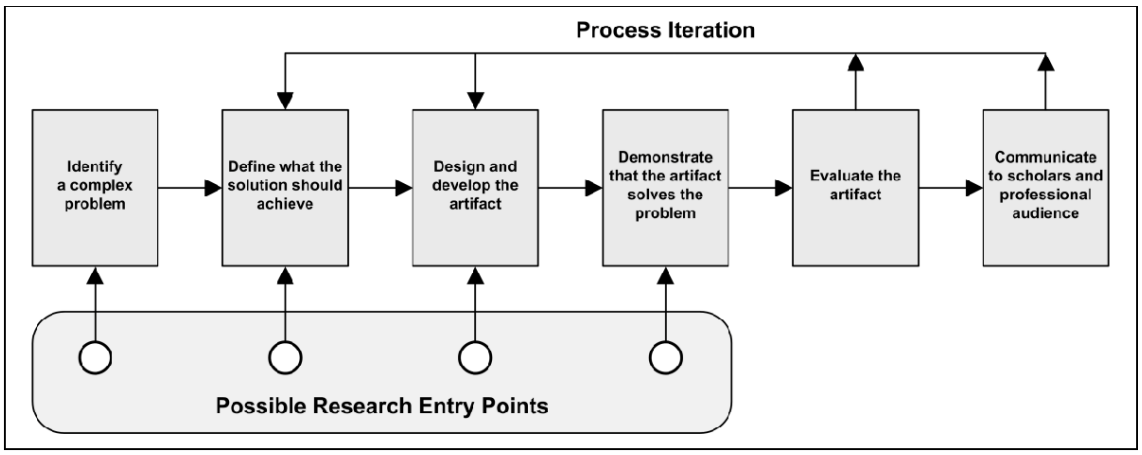

Figure 1 - Generic Process Model for a Design Science Research Methodology (DSRM) [28].

It is important to note that there are four possible research entry points in the methodology. It means that, depending on the problem or context, a researcher may opt to skip an activity. Peffers *et al* [27] states that even though DSRM for IS has six ordered activities, researchers are not expected to follow it from activity one through six strictly.

The nominal sequence, starting with activity one, is problem-centered and ideal for research inspired by problem observation or follow-up studies. Alternatively, an objective-centered approach, beginning at activity two, might be triggered by an industry or research need that can be addressed through artifact creation. A design and development-centered approach would begin with activity three, typically when an artifact exists but hasn’t yet been formally evaluated as a solution for the intended

problem domain. Lastly, a client or context-initiated solution may start at activity four, inspired by a practical solution that worked in the field; here, researchers could apply a design science (DS) approach retrospectively, often as a result of consulting experience, to add rigor to the process.

This study starts at activity one, by identifying the problem, although the e-cordel platform already exists. If the objective was to evaluate the platform as is, without evolving it, the research could start at activity four, and simply formally evaluate how well the artifact would solve the problem.

In this case, the problem observed and the research question are new in the sense that it was not the first motivation behind the e-cordel platform. Besides, a new format for "cordel" literature is also proposed and built as a solution to the problem.

The next sessions depict each DSRM process activity in the context of the present study.

Identifying and motivating the problem

Problem identification and motivation involve defining the specific research problem and establishing the value of a potential solution. The problem definition guides the development of an artifact intended to effectively address the issue. Because of this, it may be beneficial to break down the problem conceptually to ensure the solution captures its complexity [27].

The problem and motivation of this study is the fact that "cordel" literature is inaccessible to print-disabled users. With this in mind, the following research question was formulated: "**Would a digital version of the "cordel" literature foster accessibility and inclusion?**" This question addresses a crucial aspect of inclusive cultural engagement and information accessibility.

In the context of the first activity of the Design Science Research Methodology (DSRM) for Information Systems, which is problem identification and motivation, this research question serves to pinpoint a real-world problem: the potential lack of accessible formats for "cordel" literature. Identifying this accessibility gap is essential to motivate the development of design-oriented solutions aimed at increasing cultural inclusivity. By articulating this problem clearly, the research highlights the need for solutions that could support the visually impaired community in accessing and

appreciating “cordel” literature, thereby preserving its cultural relevance and expanding its reach.

Solution objective

After identifying the problem, it is necessary to determine a solution for it. According to Peffers e*t al* [27], in the second activity of DSRM the researcher derives the solution objectives based on the problem definition and an understanding of feasible possibilities. Objectives may be quantitative, such as specifying how a desired solution would improve upon existing ones, or qualitative, describing how a new artifact might address previously unaddressed issues. These objectives should be logically inferred from the problem specification.

The concrete objective of this study is to create an accessible electronic format for “cordel” literature capable of mitigating the lack of content accessibility in the traditional format. This objective acquires a qualitative dimension by describing how the new solution will address the problem. Besides, this study will focus on the perception of the users about the artifact, and no metric of performance or time to complete a task will be collected.

The main goal is to evaluate whether print-disabled people will benefit or not from an electronic version of the cordel, by letting this population evaluate the experience of interacting with it.

This adheres to what was stated by Coutinho [29], where the interpretative/qualitative approach seeks to understand how individuals interpret their experiences and the meanings they attribute to them, emphasizing the need to comprehend lived experiences from the perspective of those involved within their social context.

Pernice and Nielsen [30] state that qualitative studies focus on generating insights into a design's usability rather than providing precise numerical measurements. These studies are typically faster to conduct, as they require fewer participants and are often less scripted, with somewhat less rigorous preparation. In contrast, quantitative studies yield numerical data on various usability metrics, such as task completion time and success rates. To achieve statistically reliable averages, quantitative studies require more participants but generally provide fewer insights into the root design issues, as

their emphasis lies in producing measurable results. This is particularly significant, as the number of participants in this study was not expected to be large enough to yield statistically significant results.

Design and Development

According to DSRM [27], in this phase, a design artifact is created. The artifact can be any designed object in which a research contribution is embedded in the design. This activity includes determining the artifact's desired functionality and its architecture and then creating the actual artifact.

In the scope of the present study, the artifact is the e-cordel project itself and a new "cordel" format. The e-cordel project was adapted to accomplish the objective proposed. The macro architecture was already defined and preserved.

The e-cordel is technically divided into three main components: backend, frontend, and mobile app.

The backend is a Spring Boot[1] application that exposes data through a REST API. The frontend is a Single-Page Application (SPA) developed with Typescript[2] and React[3] and responsible for presenting the data exposed by the API.

The mobile application also presents data and was developed with Dart and Flutter. Although the Flutter framework allows multi-platform application builds, only an Android version is available for this project.

The backend component was modified to allow EPUB creation and exportation, and the web application was also adapted to leverage the new content format and provide accessibility for impaired users.

Detailed information about the changes made can be found in the Design and Development section of this study.

Demonstration and evaluation

[1] https://spring.io/projects/spring-boot
[2] https://www.typescriptlang.org/
[3] https://react.dev/

Demonstration and evaluation are the next activities of the DSRM. For the sake of simplicity, they are described here together, since the evaluation depends on the demonstration.

In the demonstration activity, the researcher is expected to demonstrate the use of the artifact to solve one or more instances of the problem. In this study, this activity consisted of testing a new version of the e-cordel with individuals with special needs, specifically those with visual impairments, to assess the accessibility of the electronic "cordel".

In the evaluation activity, the research observes and measures how well the artifact supports a solution to the problem, by comparing the results observed in the demonstration activity with the expected ones [27].

To demonstrate and evaluate the electronic cordel, a mix of research instruments was used, such as questionaries, tests with users, and interviews. The study took the following approach:

1. Recruiting participants;
2. Submit a prequestionnaire to identify the reading habits of the participants and other information;
3. Request participants to test the platform;
4. Interview participants to gather feedback.

The questionaries, interview questions, and interview transcripts can be found in the appendix of this work.

Sample selection

The sample selection initially followed two non-randomized approaches, accidental sampling, and snowball sampling. The accidental sampling method involves volunteers who willingly opt to participate, and snowball sampling allows new individuals to be recruited by other participants already in the study to form part of the sample. Snowball sampling can be a useful way to conduct research with people who might be difficult to identify [29] which is the case.

To facilitate participant recruitment for the study, two Brazilian universities were contacted via e-mail: the Universidade Federal do Cariri and the Universidade Regional do Cariri. The Instituto de Superior de Tecnologias Avançadas de Lisboa (ISTEC) was also contacted.

The e-mail requested the universities' support in disseminating information about the research to students and staff who fit the target profile of the study—namely, literate young and adult individuals with visual impairments, regardless of social class, gender, or other attributes. Additionally, a dedicated web page was created on the e-cordel website to provide details about the research. This page was shared on LinkedIn to further attract potential participants for the study.

Their participation occurred in three distinct stages, points 2, 3, and 4, designed to collect insights on user experience and the accessibility of digital reading platforms.

Requesting participants to test the platform and reading electronic “cordel” can be considered as the demonstration part of the methodology, since it shows one instance of the problem being solved by the artifact. Detailed information about this activity can be found in the Demonstration section of this work.

The prequestionnaire and the interview were necessary to gather enough information to allow the evaluation of the artifact. The evaluation of the electronic “cordel” was conducted through quality questioning. Questioning is the process of acquiring direct answers from study participants and it could be implemented using interviews or inquiry [29].

In the evaluation activity, the researcher observes and measures how well the artifact supports a solution to the problem, by comparing the results observed in the demonstration activity with the expected ones [27].

The participants selected for this research were submitted to a semi-structured interview at the end of the iteration to give feedback about the accessibility and usefulness of the new version produced in the design and development activities.

Coutinho [29] states that the contact between the researcher and the interviewed allows the researcher to adapt and ask for more information if needed. It was important in this case since the sample used consisted of individuals with special conditions. Besides, since all interviews were performed remotely, not having a rigid structure helped the researcher to adapt the interactions with participants, be it due to time zone issues or schedule constraints.

The evaluation activity is detailed in a later section of this study.

Communication

The communication activity is used to transmit the problem and its importance, as well as the artifact, its utility, and the evaluation process [27].

According to [27], researchers might use the structure of this process to structure the paper. This is exactly the case in this paper. The publication itself serves to communicate the design science research performed.

The following sections of this paper provide a detailed explanation of the design and development, demonstration, and evaluation phases of the research, as outlined in the Design Science Research Methodology (DSRM). Each phase is thoroughly examined to showcase the steps taken throughout the research process.

In the design and development phase, the conceptualization and evolution of the e-cordel platform are described, focusing on the accessibility features implemented to enhance usability for visually impaired users. The demonstration phase outlines the practical application of the platform, including the testing process where participants interacted with the new format, offering insights into its real-world functionality. Finally, the evaluation phase presents an in-depth analysis of the feedback collected from users. Each phase illustrates the progressive steps taken by the researcher to develop and assess the e-cordel platform.

Design and Development

The e-cordel project consists of three main components, a REST API, a web application that consumes the data exposed by the API, and a mobile application that also consumes the data.

Before diving deep into the changes in design and development, it is important to understand the architecture of the e-cordel project. The image below shows how the platform was built and how it is maintained.

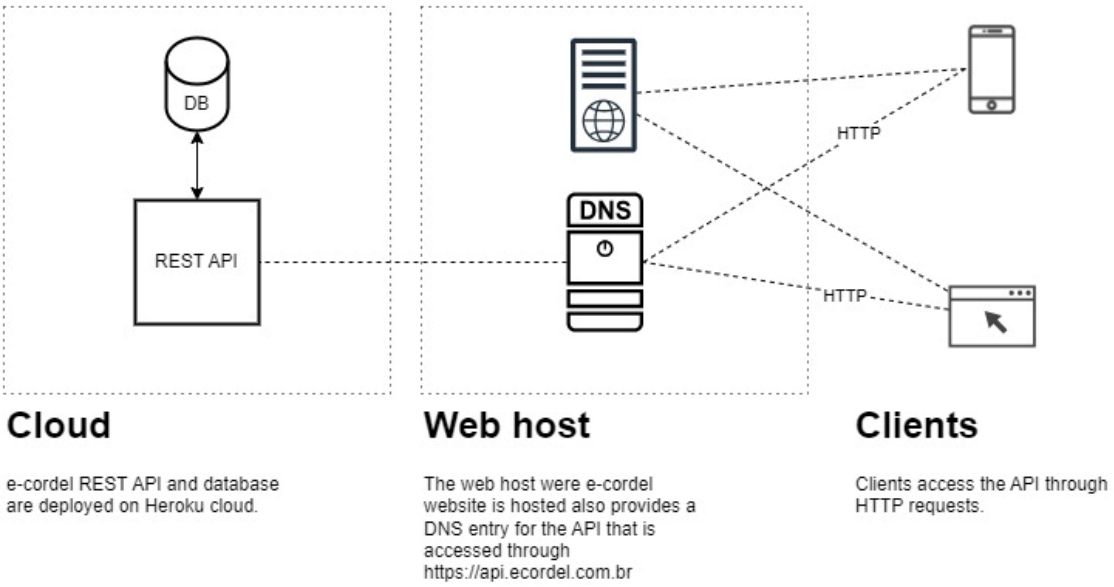

Figure 2 - e-cordel architecture.

The e-cordel REST API is a microservice built in Java and Spring Boot, and it is currently deployed on the Heroku cloud. The API is exposed via HTTP methods. The clients, web, and mobile, are not directly coupled to the backend URI, the address used by them is a subdomain defined in the DNS server where the e-cordel website is running. This was necessary to avoid issues when the backend application receives a new address, which occurred in the past when the application was migrated from Amazon AWS to Heroku. In this way, the only thing that needs to be changed is the DNS configuration. This comes in handy when we consider clients with long deployment lifecycles, like mobile apps that need some time to be approved and published by Google Playstore, for instance.

To allow users to read “cordel” works in EPUB format, it was necessary to generate them and expose this new information in the REST API for the web application. The subsections below explain what was done, the technical decisions, and the details involved.

Adapting the mobile app to present the EPUB was also considered at first, but this was descoped because it was evident that the lack of knowledge about the target users of the study would make it harder to include the mobile app. First, because it is Android only, it would eventually exclude volunteers with different devices, apart from that, since the objective was to provide access to “cordel” literature to a group of people, it became important to let the participants use the device that suited them the most.

Because of this, a broader approach was selected, use the internet version and ask them to read and download the work.

REST API

A REST (Representational State Transfer) API, as defined by Roy Fielding in his dissertation [31], is an architectural style for distributed systems like the web. It emphasizes stateless interactions, where each request from a client to a server must contain all necessary information for the server to understand and process it. REST relies on a uniform interface (often using HTTP methods like GET, POST, PUT, DELETE) and represents resources via URIs, enabling scalability, simplicity, and flexibility across distributed systems.

According to Fielding [31], anything that can be identified or given a name qualifies as a resource, be it a document, an image, a time-based service, a group of resources, or even a physical object (such as a person), among others.

The main resources in the e-cordel API are the “cordel” itself and the author. The “cordel” resource was changed to include a new attribute, the e-book URL. This attribute was used to hold a link for the EPUB file and it is consumed by the clients to decide if they should show a download button or not.

The e-book URL was exposed as a new endpoint in the REST API to allow this resource to be set by the script that generates the EPUB file. The resource can be manipulated only through a PUT HTTP method, and it was defined as follows: /cordels/{id}/ebook-url. The {id} part of the URI represents a path parameter that should be sent by the client, and it maps to a “cordel” id. In this way, the endpoint expresses that the ebook-url is a sub-resource under “cordels” and belongs to a specific one. The PUT method was selected since, according to HTTP specification [32], PUT should be used when the state of the target resource should be created or replaced with the state defined by the representation enclosed in the request message content. In this case the target resource is represented by the URL itself.

The REST API specification of the e-cordel can be found in its repository. The specification was written following the OpenAPI[4] standard.

[4] https://swagger.io/specification/

The new attribute was also created in the database using a Flyway[5] database migration script. Creating a database migration file to add new columns to an existing table using Flyway is a systematic process that ensures database schema changes are versioned and applied consistently. This procedure creates a new migration file within the designated Flyway directory, detailing the SQL statements required to modify the schema, such as adding new columns to a specific table. This migration file is assigned a unique version number, ensuring proper sequencing and tracking of database changes. When the Spring Boot application starts, Flyway automatically detects the new migration and executes it, updating the database schema accordingly. The image below shows the Entity Relationship Diagram (ERP) generated from the database using pgAdmin tool.

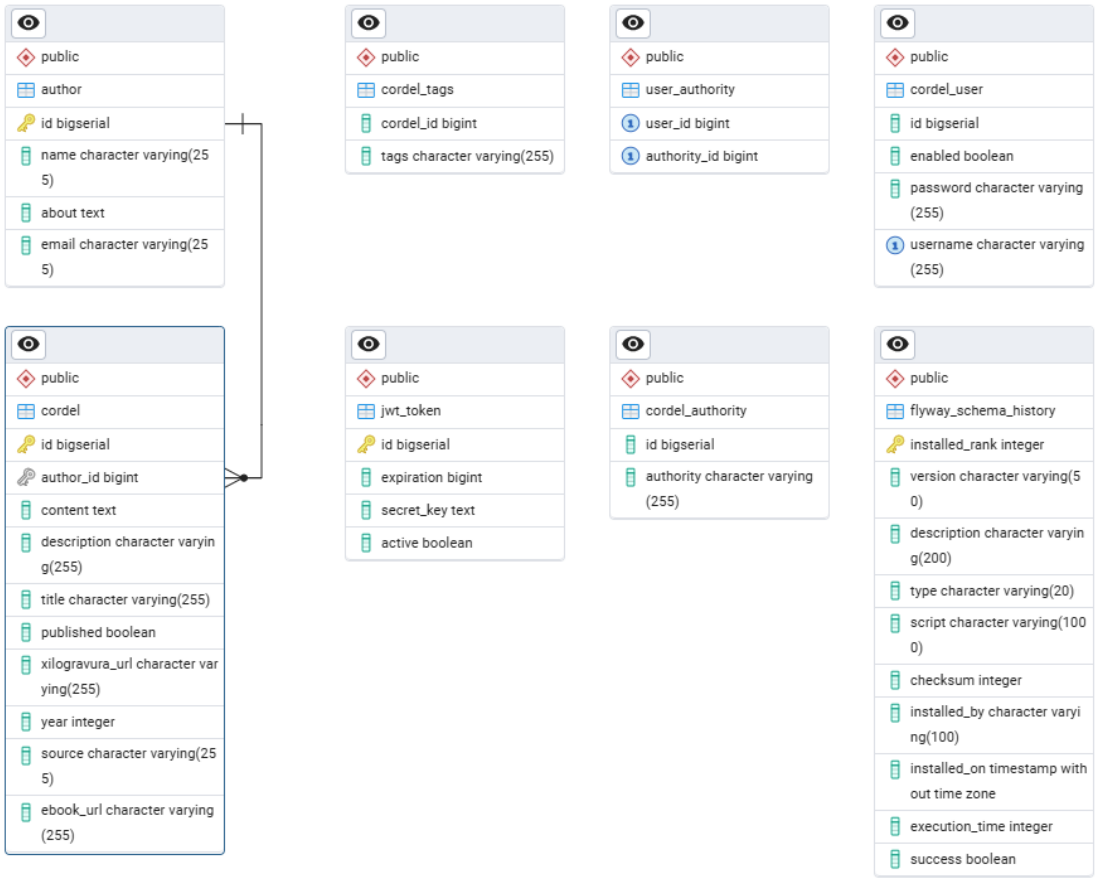

Figure 3 - Entity Relationship Diagram.

[5] https://github.com/flyway/flyway

This integration between Flyway and Spring Boot ensures that the database remains synchronized with the application's evolving requirements. Additionally, the deployment pipeline is configured to automate this process: each time changes are merged into the main branch of the repository, a set of automated checks, including unit tests and integration tests, are run. If all checks pass, the updated application, along with its database migration, is automatically deployed to Heroku. This continuous integration and deployment (CI/CD) approach guarantees that database updates are seamlessly applied alongside application changes, promoting stability and reducing manual intervention in production environments.

EPUB generation

To generate the EPUB files, a Python script was created to fetch data from the REST API and build the EPUB. The EbookLib[6], a Python package, was used to generate the files.

It was also considered to do this processing in Java in the REST API as soon as a "cordel" is created. Nevertheless, it was not found a good project for this. Most of the Java projects were outdated without recent commits or only supported EPUB 2. A search on Git Hub was done using "java" and "epub" as keywords.

Apart from that, the amount of work necessary to accomplish this in Java was considered greater than with Python, since in the later case only an ad hoc script was created. Doing this in Java and adding this to the API would require the application to also expose a new resource endpoint or mechanism to process the works that already exist in the platform.

That being said, and for the sake of the time, the Python script appeared to be a tactic and a better option for this study. It does not mean that this responsibility should not be included in the API. This will be handled as a future work.

Generating EPUB files using Python and the EbookLib library was a structured process. The objective of this procedure is to automate the creation of EPUB files by sourcing book data from an API, processing the information, and validating the final output to ensure compliance with industry standards. This method is particularly valuable in contexts where large volumes of content need to be distributed in a format

[6] https://pypi.org/project/EbookLib/

compatible with e-readers and digital libraries. Besides, an error in the EPUB structure could potentially mean inaccessible content later, which could impact the tests with impaired people. The UML sequence diagram below depicts the steps taken by the Python script.

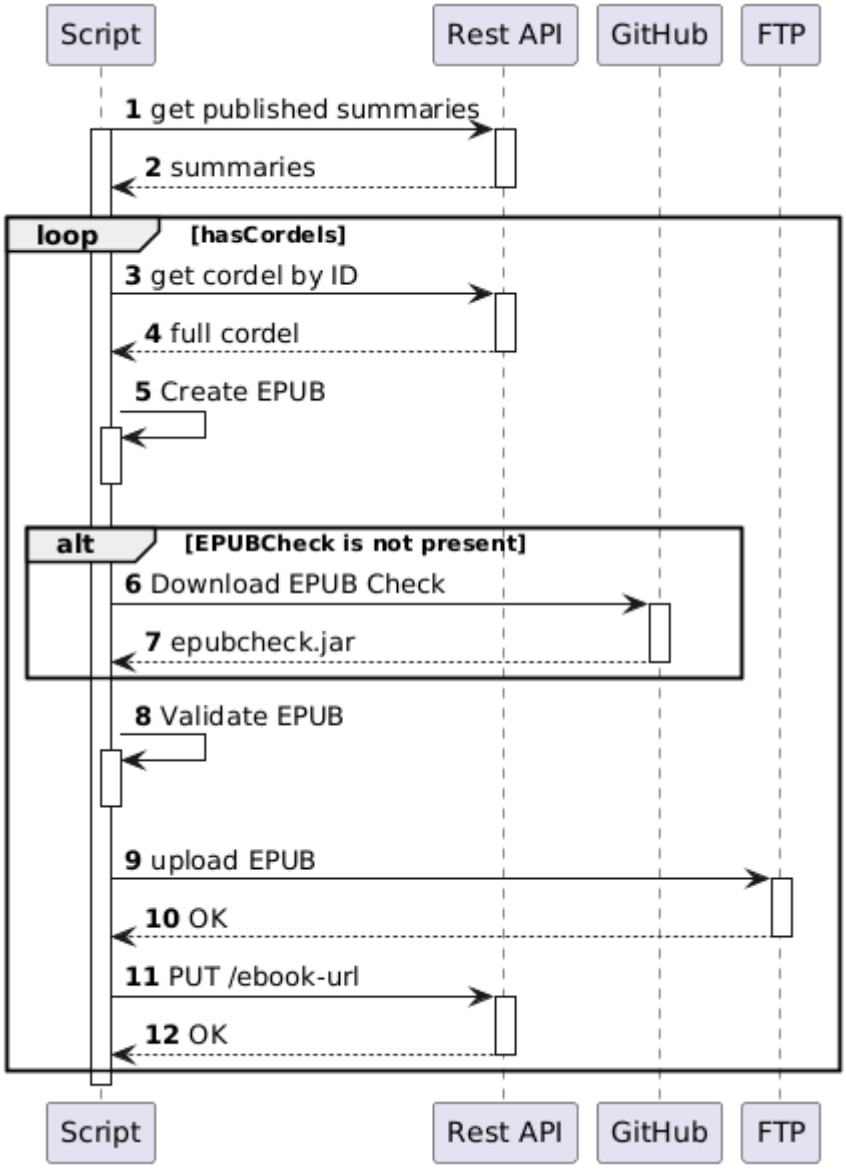

Figure 4 - EPUB Generation UML Sequence Diagram.

The script initiates by establishing a connection to a designated API, from which it retrieves metadata and content for each published cordel. The API provides details such as the title, author, content, and other relevant data in a structured format, JSON. Upon receiving this data, the script utilizes EbookLib, a Python library designed for handling EPUB files, to create a new EPUB for each book. EbookLib facilitates the

creation and manipulation of the various components that comprise an EPUB file, including the cover, metadata, and individual HTML-based chapters. Each section of the book is converted into HTML and inserted into the appropriate part of the EPUB structure, ensuring that the flow and formatting align with standard reading experiences.

In addition to generating the content, the script incorporates validation checks using the EPUBCheck[7] project. EPUBCheck is an open-source tool maintained by the International Digital Publishing Forum (IDPF) to validate the conformance of EPUB files to the EPUB specification. By integrating this validation step, the script ensures that the generated EPUB files meet all technical requirements, preventing errors that might otherwise lead to compatibility issues with e-readers or reduce accessibility. This validation phase is crucial, as it identifies structural or metadata-related inconsistencies that could hinder the readability or distribution of the book.

Ultimately, this process results in a set of well-formed EPUB files. By automating both the generation and validation of EPUB files, the script not only streamlines the production of digital books but also guarantees their adherence to widely accepted standards in the publishing industry.

In the e-cordel data model, the "cordel" content is not represented in pages, as in the original work. It means that all content is just a string. For EPUB files, the page concept does not exist either, since the content will occupy the entire available space in the screen.

In this case, the only thing necessary to create the EPUB was to convert the content into XHTML (eXtensible Hypertext Markup Language) since this is the default format used in EPUB files. To do this, each strophe became an HTML paragraph, and a break line was appended to each versus to guarantee that the next line starts below the other, as depicted in the table below. Without this, the text would be rendered in only one line since white spaces are usually ignored when HTML is rendered.

e-cordel content	XHTML content
… Olá, amigo leitor\nEm versos para você\nDirei um pouco o que é\nEssa tal de "Esse-Bê-Cê" \n Sociedade	<p> Olá, amigo leitor Em versos para você Direi um pouco o que é

[7] https://www.w3.org/publishing/epubcheck/

científica\nQue de tão magnífica\nVale dizer o porquê. \n\n …	Essa tal de “Esse-Bê-Cê” Sociedade científica Que de tão magnífica Vale dizer o porquê. </p>

Table 6 - Original content vs HTML formatted content.

The entire content was wrapped in a section tag to provide extra context for the users and screen readers. An epub:type attribute was also included with the value chapter. The epub:type attribute is used in EPUB files to provide semantic information about the content, enhancing accessibility and navigation within the document. It helps identify the role or structure of specific elements in the content, such as chapters, footnotes, or references, by assigning standardized types defined in the EPUB Structural Semantics Vocabulary. This attribute enables reading systems, such as e-readers or screen readers, to interpret and present the content more effectively to users [33].

As stated by [33], EPUB is not just a specification, it is a publication format, and it specifies what the publications need to include, such as documents, style sheets, images, media, and more. The image below depicts the structure of the EPUB file generated by the script.

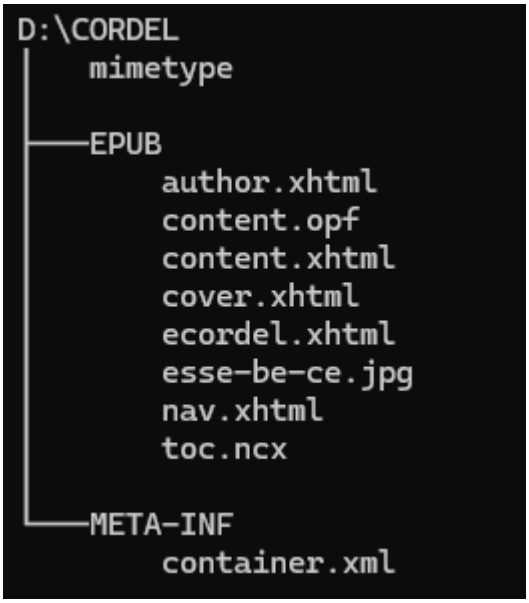

Figure 5 - Structure of the EPUB generated by the script.

An EPUB file consists of several mandatory components that form the foundation of its content and structure, ensuring compatibility across various e-readers. The first key file is mimetype, a plain text file that identifies the file format, ensuring that devices recognize the file as an EPUB. According to [33], the mimetype file must be added first to indicate that the ZIP file contains an EPUB, and a file container.xml must go into a directory named META-INF. The mimetype file contains only the following text: application/epub+zip. The EbookLib takes care of this process, and it was not necessary to control the order in which each file was added to the package.

Another essential file is META-INF/container.xml, which defines the location of the EPUB's primary content file, usually referred to as the OPF (Open Packaging Format) file. The OPF file, located in the root directory, serves as the central manifest and metadata file, listing all the resources (e.g., HTML content, images, CSS) and their relationships, while also providing key metadata like title, author, and language.

The toc.ncx file is another important component, which contains the navigational structure of the EPUB, allowing users to jump between chapters and sections via a table of contents. It is mentioned in [33] that NCX format, used in EPUB 2, is complex but it is still used when is necessary to target EPUB 2 and 3. This is exactly the case here, and a nav.xhtml was also provided.

EPUB 3 introduces nav.xhtml, a more flexible and powerful navigation mechanism built on HTML5. The nav.xhtml uses the <nav> HTML element and supports complex structures, such as multiple navigation sections (e.g., lists of figures or footnotes). This format also significantly improves accessibility, offering better integration with assistive technologies and supporting multimedia and interactive content, which were not possible with toc.ncx. This shift from XML to HTML-based navigation reflects EPUB 3’s alignment with modern web standards and its emphasis on richer, more accessible digital publications [33].

Lastly, the EPUB contains the XHTML content files, which represent the actual text of the book. The author.xhtml is a section about the “cordel” author, the content.xhtml is the entire content of the cordel, and an extra section was added to provide information about the project, the ecordel.xhtml file. Together, these files form a cohesive digital book, combining metadata, content, and navigation to create a seamless reading experience across different devices and platforms.

Frontend

In the web application, a download button was added directly to the reading page, allowing users to download EPUB files for offline reading on their preferred devices. Before this feature, users could only access the content online within the application, without the option to save it locally.

The new button was designed to fit seamlessly into the interface and, when clicked, it initiates the download process, enabling users to easily save the EPUB file to their devices. This update not only improves convenience but also extends the functionality of the platform, empowering users to read on their own terms, using e-readers or other devices suited to their preferences. The image below shows the new button on a “cordel” page.

Figure 6 – “Cordel” page on the web interface displaying the download button.

Accessibility tests

Before conducting user testing with individuals with impairments, an accessibility analysis was carried out using Lighthouse, a tool available within Chrome DevTools. This static analysis was essential to identify and address accessibility issues early in the development process, ensuring that the platform would be more inclusive and usable by all users. The analysis focused on two key pages: the home page, which includes a search input for locating works, and the reading page, where users can engage with content.

The Lighthouse analysis revealed a few accessibility issues. On the home page, the main search input lacked an appropriate ARIA label, which meant that screen readers were unable to announce the purpose of the input field, making it difficult for visually impaired users to understand its function.

On the reading page, the structure of heading elements was not in a sequentially descending order, which could confuse users who rely on screen readers to navigate the content logically. Additionally, in the navigation menu, the button used to toggle dark mode lacked a proper accessible name. As a result, screen readers would announce it generically as a "button" without giving users context about its purpose.

The issues found on both pages match the challenges exposed by Mankoff, Fait, and Tran [34]. The authors stated that the challenges encountered by blind people vary from minor frustrations, such as poorly labeled links that waste time and effort, to major barriers that prevent task completion or require assistance from a sighted individual. Critical issues include essential information displayed solely in graphic form and form fields with incorrect or missing labels, which severely impact accessibility. Apart from this, it is also stated that websites are often so inaccessible that blind users are unable to access the full range of information available to sighted users

To guarantee a good level of accessibility, the issues found were corrected. Labels were added to the search input and the dark mode button, allowing screen readers to properly announce their functions, and the heading elements on the reading page were reordered for better navigability.

To address ARIA-related accessibility issues within a React application, the aria-label property serves as a crucial tool for enhancing screen reader compatibility.

This attribute allows developers to assign descriptive labels to elements that may not have visible text, such as buttons or input fields, ensuring that assistive technologies can correctly interpret and announce the element's function. By incorporating aria-label in React components, it was possible to improve the accessibility of the application, fostering a more inclusive user experience.

After that, a new test was executed on both pages and the accessibility score improved significantly, as can be seen in the table below.

Page	1st accessibility score	2nd accessibility score
Home page	89	100
Reading page	89	96

Table 7 - Accessibility scores generated by the Lighthouse tool.

The accessibility analysis using Lighthouse revealed significant improvements after addressing key issues on both the home and reading pages. Initially, the home page had an accessibility score of 89, which increased to 100 after resolving the identified problems, such as missing ARIA labels for the search input. Similarly, the reading page's accessibility score improved from 89 to 96, following fixes related to the improper heading structure and the unnamed dark mode toggle button. However, one issue related to insufficient contrast between background and foreground colors on the reading page remained unresolved for the purpose of this study. The Lighthouse gave the following indication: “Low-contrast text is difficult or impossible for many users to read”.

While this contrast issue could further enhance accessibility, it was not addressed since the target audience of the study was not color-blind users, and it was considered not critical.

The Lighthouse analysis was performed with the default parameters and provided valuable insights beyond accessibility, highlighting areas for improvement in overall performance. It identified several opportunities to enhance the platform’s speed and efficiency. One key suggestion was to compress response content, which would reduce the size of data being transferred and improve loading times. This optimization, however, would need to be implemented within the backend service. Additionally, Lighthouse recommended resizing and reducing the image files used as “cordel” covers,

as smaller, optimized images would further contribute to faster page loads and a more responsive user experience. These performance improvements, though not directly related to accessibility, would significantly enhance the platform's usability for all users.

The report also stated that automatic detection can only detect a subset of issues and does not guarantee full accessibility of the web app, manual testing is also encouraged.

This statement is supported by the study [34] where the authors affirm the issues that automated tools can detect without manual review are limited. Besides, some tools may mistakenly indicate significant accessibility problems on sites that are adequately accessible.

Nevertheless, performing this static analysis before testing with real users was crucial. It identified fundamental accessibility flaws that could otherwise impede user interactions during testing. By resolving these issues beforehand, the subsequent user testing could focus on more nuanced user experiences and feedback, rather than being hindered by basic accessibility issues. This approach not only saves time but also fosters a more inclusive design process, ensuring that the platform is usable and accessible to more users.

This static accessibility test section was included in the development section since the researcher considered that the development was not completely done until all automatic tests were performed. It was also considered that evaluating the platform with static tools does not demonstrate that people with visual impairments would be able to access the content, that is, the solution to the problem identified could only be demonstrated by real users.

Demonstration and evaluation

To demonstrate that an electronic version of “cordel” can be one solution for the lack of accessibility in traditional cordel, participants were asked to complete the following tasks:

1. Answer a prequestionnaire.
2. Test the platform.
3. Participate in an interview.

In total, nine individuals participated in the study. Four of them identified themself as blind, four as having low vision, and one having color blindness. All of them are Brazilian citizens. The table below summarizes some important data about the participants.

ID	Age	Gender	Light Perception	Impairment
P1	20	F	Yes	Low vision
P2	35	M	No	Blindness
P3	46	M	Yes	Blindness
P4	22	M	Yes	Low vision
P5	31	M	No	Blindness
P6	33	M	Yes	Color blindness
P7	32	F	No	Blindness
P8	44	M	Yes	Low vision
P9	32	M	Yes	Low vision

Table 8 - Participants summary.

The interaction with the participants was done mainly by e-mail and instant messaging to set up interviews. Audio instructions were created to facilitate the study, instead of only providing text the researcher also sent a voice message with the instructions to blind participants.

The first activity involved participants completing a prequestionnaire to identify their reading habits and preferences. Participants used the e-cordel platform in the second stage by reading two “cordel” works, one online and another by downloading the EPUB file. Lastly, participants provided feedback on their experience with the platform through a semi-structured interview with the researcher, offering valuable insights into the platform's accessibility and usability from the perspective of visually impaired users.

The first questionnaire, despite not being directly related to the demonstration activity of the DSRM was crucial to gather more intel about a community that the researcher did not know well. Apart from that, it helps to evaluate the artifact and drive conclusions at the end.

The main goal of the first questionnaire is to understand how the target population consumes digital books and how much they know about the formats involved.

It was expected that with this questionnaire, the researcher could select the best interface to test the electronic cordel. Unfortunately, since the time was not enough and the sample was hard to contact, the questionnaire was eventually used to profile the participants. The questions present in the first questionnaire can be found in the appendices.

The prequestionnaire was divided into three parts: personal data, reading habits, and “cordel” literature. Apart from the personal questions, such as gender and age, one question about visual acuity was included. The question required the participants to rate their visual capabilities in a range that started from zero to seven, where zero represents total blindness without light perception, and seven represents normal vision without corrective lenses. The values were adapted from ICD-11 table “9D90 Vision impairment including blindness” [35] excluding the “Undetermined” option.

This question was used to help the researcher identify the level of impairment without rigorous tests. The condition was later confirmed in the interview.

While all of them said they used to read digital books, only two indicated that they used EPUB as an e-book format. The majority, 75% of the participants, indicated PDF as the format of choice.

Most of the participants said that they acquire e-books from free sources on the internet or from friends. Only three participants said that they buy e-books. About the devices used, it was noticed that mobile devices are more utilized than normal computers.

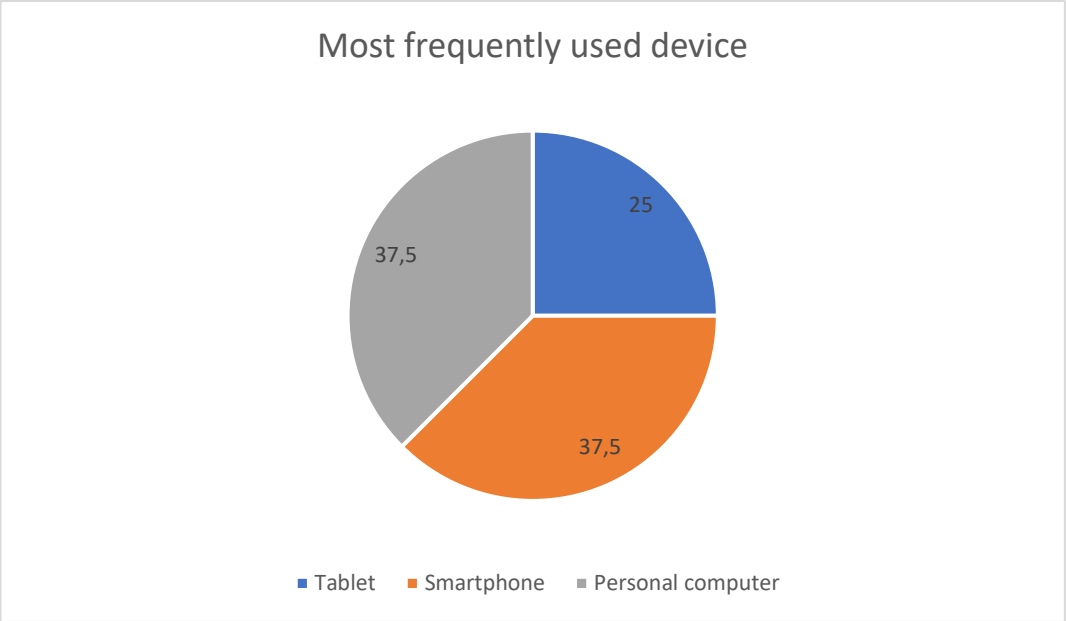

Figure 7 - Most frequently used device.

Some assistive technologies were also mentioned by the users, such as screen readers Talkback, NVDA, Voice Dream.

All the users answered that they were familiar with “cordel” literature. It may have occurred because most of the participants were from the Brazilian northeast region, where “cordel” literature is more prominent.

The last part of the prequestionnaire was dedicated to “cordel” literature and access to it. It was explicitly asked if the participants knew and had already read or listened to any “cordel” work. The questions Q15 to Q19 helped the researcher to validate if an accessible “cordel” was hardly found as indicated by the literature review.

In fact, blind participants mentioned that they only had contact with accessible copies of cordel, whether printed in braille or narrated, in school for specific events.

Demonstration

The second task of the participants of the study corresponds to the demonstration phase of the Design Science Research Methodology (DSRM) for Information Systems (IS). Participants used the e-cordel platform and its new digital format in this phase by reading two “cordel” works. This stage demonstrated the practical application of the developed solution in a real-world context, providing essential data on its usability and accessibility. The results collected during this demonstration were used in the next

phase of the DSRM process, the evaluation phase, where the platform's effectiveness was assessed based on user feedback.

The second task's instructions were e-mail using the information collected in the prequestionnaire. In a few cases, the same instructions were shared by instant messaging.

The instructions provided detailed steps for participants to follow as they engaged with digital “cordel” literature. Participants were directed to read two pieces of “cordel” literature on the e-cordel platform. The instructions for the second phase were as follows:

1. First, participants were asked to access the e-cordel reading platform via the provided link and read any online “cordel” of their choice without downloading the work.
2. Next, participants were instructed to search for a specific “cordel” titled *"Mainha o maior pistoleiro do Nordeste"* on the same platform. They were to download this particular work and read it using their preferred device. It was emphasized that the downloaded work should not be read on the platform itself.

These steps were designed to observe participants' interactions with different formats, focusing on their experience with both online and downloaded versions of the digital cordel.

The first task was meant to give the users an experience with electronic “cordel” in a web format. No specific work was recommended, but the researcher only asked to read any cordel. It was also expected that the users could compare the web version versus the EPUB version to assess which one is better, if any.

The second task asked the participants to download and read a specific work in EPUB format. The requirement for participants to search for a specific “cordel” piece, *"Mainha o maior pistoleiro do Nordeste,"* served an additional purpose beyond merely providing reading material. The suggested work has no special role in the study, and it was selected based solely on the length of the text to avoid suggesting a long text that could impact or make participation harder.

This step allowed the research to minimally test the platform itself, ensuring that participants could effectively navigate the e-cordel platform to locate a specific work. Although the primary goal of the study was to assess the accessibility and user

experience of the digital formats (online and downloaded versions), using the platform's web interface was an integral part of the process. By requiring participants to locate and download a specific title, the study could confirm that users could manage basic navigation tasks, which supports evaluating how well the digital format facilitates interaction with "cordel" literature in an online environment.

Mankoff, Fait, and Tran [34] state that user testing is a widely used and effective method for identifying accessibility issues. The Nielsen Norman Group has published comprehensive insights on conducting user studies with participants with disabilities [30], detailing both the nature of these studies and best practices for implementation. Such studies are highly effective, as they reveal the specific challenges real users encounter on a website. However, user testing with specialized populations often exceeds the expertise and budget of typical web developers and requires more time than alternative methods.

Clark [36], as cited in [34], identifies several challenges that may prevent testing with disabled users, such as the difficulty of recruiting participants and ensuring the accessibility of the testing environment.

Both points were mitigated in this study by using a snowball sampling approach and by letting the users perform the task in their own environment. It was considered that the users had an adequate environment to test. Enforcing an environment would not be possible since all participants were based in Brazil.

Letting the participants test the electronic "cordel" on their terms also meant they would replicate a day-to-day approach they already do in real life. In fact, the study [30] recommends conducting studies with assistive technology users in their home or office environments. However, in this case, no observer was present to watch the users in real-time.

It is important to note that the goal is to evaluate whether visually impaired users have access to the content. That is, testing the accessibility of the platform was important since it is how they found the works in the formats proposed.

According to Pernice and Nielsen [30], it is important to test with high-fidelity prototypes or functional software to enable easy and accurate identification of major flaws. However, once the software has been coded, redesigning and recording the product generally requires significantly more effort.

By completing the second task, a participant would have read at least two works, one online and another offline. However, a participant may not be able to complete the second task since an EPUB reader would be necessary.

All nine participants were able to read a “cordel” in a web format, four of them were not able to open the EPUB version on the first try because they did not have an EPUB reader installed on their devices.

When the participants reached out to the researcher for further assistance, it was recommended to install an EPUB reader in the device, but not a specific one. Two of the participants were able to install an application and read the proposed word. One opted to read it in the online version, which was not expected, and the other one did not complete the task.

One of the participants mentioned that a PDF file was expected and did not recognize the EPUB format. In fact, most of the users indicated in the prequestionnaire that PDF is the format they are used to use. All the participants are to some extent acquainted with digital publications.

Failing the second task also provided good feedback to the research since it indicated how familiar the participants were with the EPUB format. After all interactions with the participants, only two of them did not read the EPUB file.

Regarding devices and technology used, the small sample of the study produced a diverse demonstration of the artifact usage for both formats, as depicted in the charts below.

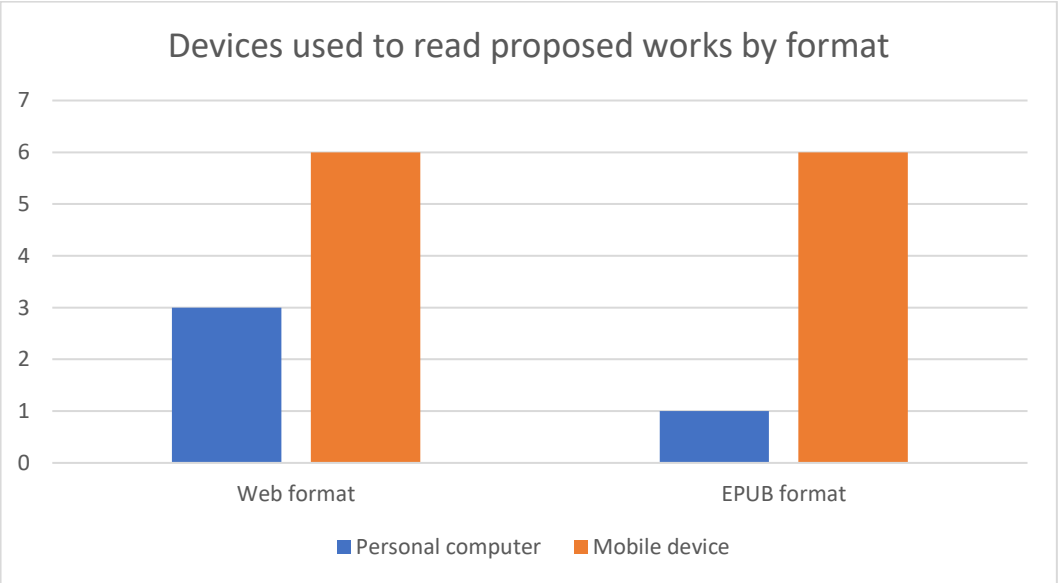

Figure 8 - Devices used to read proposed works by format.

It is possible to notice that mobile devices were most used in both cases to read the web version and the EPUB version. For the web format, four different versions of iPhone and two different versions of Android smartphones were used. One of the computer users was not able to read the EPUB version, a second one switched to a mobile device to read the EPUB, and the third one kept the computer as the device of choice. One iPhone user switched to an Android device to read the EPUB file.

Out of the four blind individuals, two used Chrome on a computer with an NVDA (Non-Visual Desktop Access) screen reader, and the other two used Safari on an iPhone device with VoiceOver to read the online version.

Still, on the web format, two users with low vision used Safari on iPhones, one participant used Chrome on a Windows computer, and the last one used Chrome on an Android device. The color-blind participant also used an Android device, but Edge was used as the browser.

While the web version was accessed by three different browsers (Chrome, Safari, and Edge), the EPUB format was read in a wider variety of applications. The table below summarizes the applications or programs used by the participants to read the EPUB format.

Platform and Program		Number of participants
Android	Envisioneye	1
	Lithium	1
	EPUBReader	1
	Google Play Books	1
iPhone	VoiceDream for iPhone	2
Computer	Balabolka	1

Table 9 - Platform and program used to read EPUB format.

Blind participants used VoiceDream, Lithium, and Balabolka. Low-vision participants used Envisioneye and EPUBReader. The color-blind participant used Google Play Books.

The demonstration phase was concluded with all the participants accessing the “cordel” in at least one format, and only two were not able to read the EPUB file. In the

course demonstration, the time of completion was not tracked due to two primary factors. Firstly, the absence of direct research supervision during the task rendered precise time tracking unfeasible. Secondly, the participants were located in a different country, which further complicated synchronous data collection and real-time monitoring. Consequently, these circumstances led to an inability to accurately document the duration of task completion.

The artifact evaluation is presented in the next section based on the feedback provided by the participants during the interview.

Evaluation

To evaluate the artifact, a semi-structured interview was conducted with the participants to gather feedback about the e-cordel platform and EPUB format. The base questions and the interview transcripts are in the appendices.

To ensure anonymity, each individual will be referred to using codes such as P1, P2, and so on throughout the research when necessary. This approach maintains confidentiality by avoiding any direct association between participants' identities and their responses. Similarly, the interview transcripts will be labeled with these codes and presented in no particular order. This method safeguards participants' privacy while allowing for the clear organization and analysis of the data collected.

The interview began by reviewing the prequestionnaire answers to confirm the participants' clinical condition and clarify some points about their reading habits. The results are presented in a high-level perspective first, followed by a detailed analysis of each interview question.

The evaluation's first result was that the participants considered e-cordel accessible. As mentioned before, all nine participants were able to read a “cordel” in a web format. This means that the e-cordel platform was accessible enough to this heterogeneous group.

Another important metric that corroborates with the last statement is that all participants also found the work they had to download. This is evidence that searching works in the platform was also doable.

Nonetheless, it is important to mention that the platform has a simple interface and at the time of the study only 22 works were published. It is not possible to say if the

numbers of the works impacts or not when searching a specific cordel. The image below shows the home page of the platform. The search box is one of the first elements and it has an accessible name.

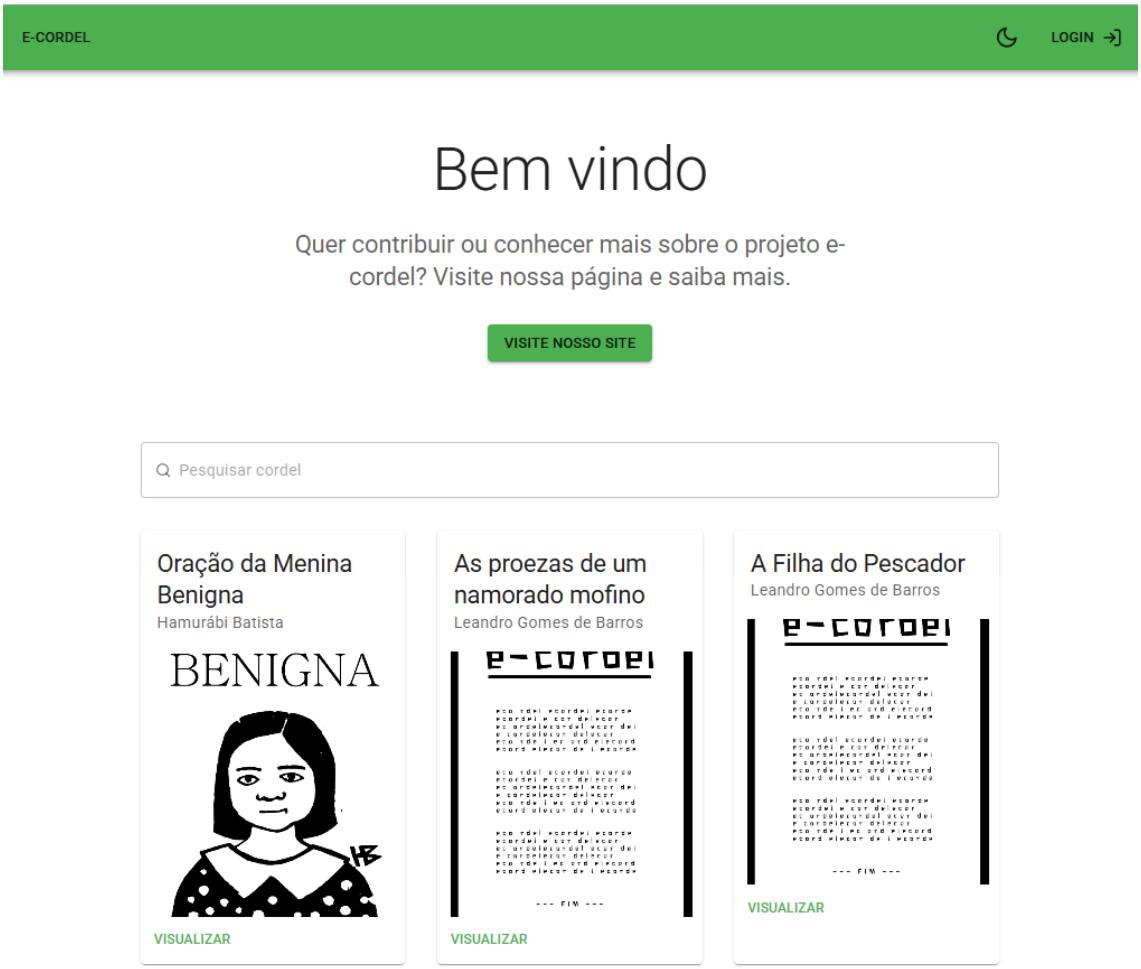

Figure 9 - e-cordel home page.

Another point to keep in mind is that the participants seemed to have a good amount of experience with assistive technologies. All blind participants auto-evaluated themselves as advanced users.

Participant P3 faced some challenges in downloading the work, but not finding it. The participant mentioned that an error on the platform prevented the download. It was not found any issues in the logs and it was assumed that the problem was a temporary infrastructure instability.

The participant P1, when asked to provide feedback about the platform said “I found it very good because the background was black—I don’t know if that’s the site itself. The text had a larger title in bold. I managed to read it easily”. Here the participant

refers to the color switch that changes the platform between light and dark themes. The e-cordel platform tries to identify the user preference that was set through the operating system and load the theme accordingly.

Participant P6 also points out that the contrast in black mode was good enough, specifically because this participant has color blindness. "*I read for more than 10 hours at night, and it was set to my phone's default dark mode… the dark background provides good contrast, doesn't it? The green stands out well against the black…*"

Another important comment was made by another blind participant. Participant P3 said that it was easy to read the "cordel" in the platform and had no difficulty. P7, who is also totally blind, when asked to give feedback about the platform e-cordel said *"For me it was super accessible, I quickly managed to find an interesting cordel and opened it, read it without any difficulty".*

Apart from the download issue related by P3, two participants complained about the lack of accessibility on the "cordel" cover, even though the image had an alternative text.

P5 said that *"…the screen reader read random letters…"*. It was not clear if the reader read the alternative text or tried to read the letters inside the image. Another blind participant, P7, who used a similar device and technology, did not report anything, even when asked if anything strange happened. Participant P2, who had some experience with audio descriptions, said it was unclear if there was an image there. "…f*or me, it could be an image, I'm not sure. The reader doesn't say an image, doesn't say anything. It only says the topic, the title."*

This issue reported by P2 was attributed to a lack of better image descriptions. All "cordel" covers had an alternative text that says: "Xilogravura of cordel…" followed by the title instead of describing the actual image. A better description would be something more meaningful, depicting the image and making it clear that the item was an image. According to P2, the key is to be clear and objective in the descriptions, avoid interpretations, and describe the image only. The participant's suggestion goes as follows: "*Every image, in my understanding, has to have an audio description. If those who have a good sight are seeing it, we also need to know that it is there. And we need to know what's in it. That's all, the rest is fine.*".

Based on the observations, the EPUB format appears to be a favorable option compared to the web version. When asked which version they preferred, some participants chose EPUB due to its convenience. They highlighted that EPUB files can

be accessed at any time in the future without requiring an internet connection, making it a more practical choice for long-term use.

P2 said that having the file is better because it would be possible to read it again without returning to the website. Having the file also allows sharing it later with someone else, in addition to being a backup if the site goes down.

P5 also mentioned that with the file, it is easier to apply custom configurations to the screen reader, such as speed and voice types. *"I prefer the file, not because is EPUB, but because I can apply my custom configuration. In the browser, I have to change the voice and keep the screen unlocked. With the file I can use an app of my choice already customized, in this case, I used VoiceDream. With this, I can read at my preferred speed, change voices, and highlight words, beyond being able to read with a locked screen and do something in between.".*

P6, the participant with color blindness, said that the EPUB was better because it was divided into pages, which does not happen in the web version. This is an EPUB feature that seems to be more relevant to sighted users.

Other participants, P3 and P4, preferred the web version because it was considered more fluid. P4 said that the text-to-speech on EPUB was mechanical and did not pause. At this point, it is not possible to know if it is related to the software/device used or not. In fact, P5, who seems to be a more advanced user, configured the application to read at a different pace and voice. It indicates that a screen reader configuration may impact the experience.

Two participants were not able to read the EPUB. Among the other seven participants, two preferred the web version, and the other five preferred the EPUB. However, most of them (3) preferred the file because they liked to have the work. One preferred the file to apply its configuration, and only one mentioned a specific EPUB feature as an advantage.

It is important to mention that the EPUB format seemed unfamiliar to some participants. Four out of nine participants were not able to open the EPUB on the first try. Extra information was passed and two of them were able to install an EPUB reader and continue.

Participant P8 was not able to open the EPUB file, but during the interview, the participant mentioned that the online version was accessible. Being able to manipulate the font size made it adaptable to P8's condition.

In more general terms, P9 compares the digital version of “cordel” with the traditional format on paper. The comment supports the fact that the electronic “cordel” solves one instance of a real problem. The comment goes as follows: *I found this possibility of reading a cordel in digital format much better… because the physical ones, they were written with a typing machine. Generally, the quality was not very good, also because it was very old…, and the quality made it very difficult to understand. At least, sometimes I couldn't understand a word, some words, sometimes it was blurred and sometimes the paper was also very fragile, sometimes it damaged easily, and this was difficult for me, and in the situation of having monocular vision and not being able to zoom in in some situations to facilitate reading, I found this possibility of digital much better.*

During the study, P5 suggested providing books in plain text (TXT) format, noting that it is a common and straightforward choice among blind users due to its compatibility with a wide range of assistive technologies and simplicity of use. According to the participant, some people do not know EPUB and do not have appropriate programs to open it.

Subsequent discussions with other blind individuals confirmed this preference, underscoring the need to accommodate diverse user habits and technological capabilities. Including multiple download options, such as TXT alongside EPUB, could make the platform more inclusive by meeting users where they are and reducing barriers to access. However, balancing the simplicity of formats like TXT with the richer features of EPUB, such as text navigation and multimedia support, remains an open challenge for the platform's developers. This feedback highlights the importance of flexibility in designing digital platforms for accessibility, ensuring that a variety of user needs and preferences are addressed.

All things considered, the artifact solved an existing problem in one way or another. Whether with the web or the EPUB version, impaired people successfully interact with at least one version.

Discussion

The fact that not all participants were familiar with the EPUB format or were initially unable to open it suggests that EPUB may not be as widely known as anticipated, particularly among visually impaired users. While EPUB offers many advantages, it appears that a significant portion of the target audience may not yet be equipped to utilize this format effectively. This gap in familiarity could hinder its widespread adoption, even when it is technically more accessible. However, due to the small size of the sample and regional proximities, it is not possible to affirm whether EPUB is well known. Further research should be performed to assess this.

A potential improvement for the e-cordel platform would be to evolve its mobile version to include native support for opening EPUB files, eliminating the need for third-party applications. This approach could streamline the user experience, especially for those unfamiliar with EPUB readers or facing difficulties installing additional software. However, implementing such functionality comes with significant challenges. For instance, expanding the platform to iOS, which is currently unsupported, would be essential to ensure inclusivity across popular mobile operating systems. This would require a substantial investment in development resources and expertise, particularly in creating an accessible and user-friendly reader that meets the diverse needs of visually impaired users.

While this evolution could enhance the platform’s usability, it also raises questions about the role of e-cordel in the digital accessibility ecosystem. Shifting the responsibility of constructing an accessible EPUB reader to the e-cordel developers may not align with the platform's core mission, which is to provide access to “cordel” literature rather than reinventing tools already available in the assistive technology landscape. This approach could divert focus and resources from improving other aspects of the platform, such as providing multiple download formats (e.g., TXT, EPUB, and web versions) to cater to a wider audience. Ultimately, the platform's role might be better defined as ensuring the availability of accessible formats and facilitating their use through existing assistive technologies, rather than presenting content beyond its web interface.

The community of visually impaired individuals has demonstrated remarkable adaptability in addressing the accessibility challenges. Participants shared examples of

using technology creatively, such as taking pictures of printed materials with their devices and zooming in to read them in a digital environment. Additionally, one participant mentioned frequently listening to “cordel” literature on YouTube, highlighting how platforms not explicitly designed with accessibility in mind can still serve as valuable resources. These examples suggest that while formal accessibility efforts are crucial, other initiatives, even those without a direct focus on accessibility, can inadvertently provide meaningful alternatives for engaging with “cordel” literature.

Conclusions

This study addressed the accessibility of “cordel” literature for visually impaired individuals, an important challenge given that traditional “cordel” is typically printed on paper and thus inaccessible by default. Impaired people face challenges in accessing “cordel” literature and only have access to it under special conditions. An electronic version of it has proved to be a solution for the problem, even though it is not the only solution, initiatives of reading and recording audio may also be a solution. Through the design and evaluation of the e-cordel platform and its ability to generate EPUB files, the research demonstrated that it is possible to make “cordel” literature more inclusive.

The evaluation process, which included semi-structured interviews with nine participants, highlighted the accessibility of both the web platform and the EPUB format. All participants were able to locate and read a “cordel” on the web platform, underscoring its accessibility even for a diverse group of users. The platform's simple interface and accessibility features, such as a clear search box and support for assistive technologies, played a significant role in its usability. However, issues such as insufficient descriptions for “cordel” cover images were identified, emphasizing the need for more detailed and objective alternative text to ensure a complete user experience.

The EPUB format was generally well-received, with many participants preferring it over the web version. The main reasons cited were the convenience of offline access, ease of sharing, and the ability to customize reading configurations using preferred applications. These features made the EPUB format particularly appealing for long-term and versatile use. Nonetheless, some participants encountered initial difficulties in opening EPUB files, indicating the need for better user guidance or integration of EPUB readers into commonly used devices.

Both formats have their merits: the web version was appreciated for its fluidity and immediate accessibility, while the EPUB format was valued for its flexibility and ability to be adapted to individual needs. Despite a few technical challenges, the artifact successfully addressed the core issue of accessibility, “cordel” literature was made available to visually impaired individuals in an accessible digital format, bridging a long-standing gap and expanding the reach of this culturally significant genre.

Future work should focus on improving the platform by providing different formats to download, incorporating more detailed alternative text for images, and potentially enhancing the web platform's features to provide a seamless reading experience. These improvements will further ensure that “cordel” literature becomes truly inclusive, enriching the cultural landscape for all.

As a last note, it is important to say that the e-cordel platform is openly available on GitHub, allowing anyone to examine, contribute to, or modify the project, as it is licensed under the Apache 2.0 license. This permissive licensing encourages the creation of derivative works, enabling others to build upon the achievements of this research. By making the platform's codebase freely accessible, the project fosters collaboration and knowledge sharing within the research community. In addition to its availability on GitHub, the e-cordel platform is also deployed and accessible online at no cost. Researchers are welcome to utilize both the platform and its codebase for further studies, making it a valuable resource for future investigations into accessibility and digital reading technologies.

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Appendices

Prequestionnaire questions

Q1: Email address

Q2: Name

Q3: Age

Q4: Phone/mobile number for contact

Q5: Gender

Q6: Indicate your academic degree

Q7: Country

Q8: On a scale from 0 to 7, where 0 represents total blindness and 7 represents normal visual acuity without corrective lenses, how would you assess your visual ability?

Q9: Do you typically read electronic/digital books?

Q10: Where do you usually find electronic books for personal use?

Q11: What format of electronic books do you typically use?

Q12: What type of device do you most frequently use to read/listen to electronic/digital books?

Q13: If you use any software or app to read electronic books and materials, please specify its name.

Q14: On a scale from 0 to 5, where 0 is completely unsatisfactory and 5 is completely satisfactory, how would you rate your overall experience with consuming electronic textual materials?

Q15: Are you familiar with cordel literature?

Q16: Have you ever read a cordel before?

Q17: If you have read a cordel before, tell us about the experience, where and how.

Q18: Have you ever listened to a cordel before?

Q19: If you have listened to a cordel before, tell us about the experience, where and how.

Interview Questions

Q1: Technology used to read the “cordel”?

Q2: Browser used to access e-cordel online

Q3: Were you able to read/listen to the “cordel” online?

Q4: Tell me about your experience reading the cordel online on the e-cordel website.

Q5: Were you able to find the indicated work for download?

Q6: Were you able to read/listen to the downloaded work in EPUB format?

Q7: Tell me about the experience of reading the downloaded work in EPUB format.

Q8: What did you prefer? Which was better? EPUB or web?

Q9: Digital cordel vs. physical cordel?

Q10: Provide suggestions for this project, improvements, or new features.

Interview transcriptions

Participant 1

Code: P1
Age: 20
Gender: Female
Light perception: Yes
Impairment: Low vision

Researcher:
So, this interview should last about 15 to 20 minutes, no more than that, right? And basically, I divide it into two parts. The first part is to review some answers you gave in the first questionnaire, the pre-questionnaire, and then, in the second part, talk a bit about your experience using the online platform and downloading the work to read, alright?
…
So starting with your first questions, you marked a specific question about visual acuity, correct? And on a scale from 0 to 7, you marked 4, correct? What is your current diagnosis regarding your visual acuity?
Participant:
I have retinitis pigmentosa, and my visual acuity is about 20/80.
The main issue with retinitis is that it narrows the field of vision laterally, you know? I still have quite a bit of central vision, but the issue is with the lateral vision, you know?
Researcher:
Right. That would be the peripheral vision, correct?
Participant:
Yes, the peripheral vision.
Researcher:
So, are you able to read books, both physical and digital, without any assistive tools, or do you need...
Participant:

No, it depends. It also depends if the text has contrast, bold font, or is in a good size. For example, I pick up a book in college with small text, and I absolutely can't read it, you know? I need to use my phone and an online magnifier I have here, you know? But there are books I can manage to read, you know? … But most of the time, I can't.

Researcher:

In a traditional "cordel", where the font often looks like a typewriter and is generally small… what's your experience with a physical cordel?

Participant:

Well, my condition is progressive, you know? The last time I read a cordel, I think I was 14 years old. Now I'm 20, and my condition has progressed significantly since then. So, before I could read, but nowadays, I don't think I could.

Researcher:

And regarding your use of technology, you mentioned using an online magnifier. At what level would you consider your proficiency with technology? Would you say you're an advanced user, comfortable using assistive technologies, or not?

Participant:

I think I'm advanced. I use color inversion because I also have an issue with the contrast between black and white. I see better when the background is black and the text is white, you know? And earlier, well, I also had cataract surgery, right? Before the surgery, when the cataracts were really advanced, I couldn't even see the lines on a notebook. It was that bad. That's when I learned to use accessibility features.

Researcher:

And what kind of materials do you typically use? For example, in the first questionnaire, you marked that you use PDF materials, correct?

Participant:

Yes, I have a tablet where I can zoom in and invert colors. So, it works really well on the tablet.

Researcher:

Okay, and were you familiar with other digital book formats, like EPUB?

Participant:

No, I wasn't. In fact, I couldn't open it.

Researcher:

Alright, that's fine, no problem. This format was the one I chose for the project. Theoretically, it offers more possibilities than PDF…Your feedback wasn't the first in the research, and not being able to open the book isn't a problem. It's actually valuable feedback about how common this format is among users… In your pre-questionnaire, you also marked that you had listened to a cordel. In what context was that? Was it also at school?

Participant:

Yes, it was at an event where the literature teacher had us write and listen to "cordels" being recited.

Researcher:

From your experience and the people around you, is "cordel" literature commonly accessible? For instance, in Braille or narrated formats?

Participant:

Honestly, it's not even common for people to read "cordels", let alone accessible ones, you know? I don't think it's common at all… I don't see people talking about it…

Researcher:

Okay, great. Now, moving on to the next part…The second part of the study involved reading a cordel online and then downloading it, correct? You've already told me you couldn't open the second work, but I assume you managed to download it, right?

Participant:

Yes, I managed to download it; I just couldn't open it.

Researcher:

The first part was to read any cordel on the platform, your choice.

How was that experience? Did you manage to read the cordel on the platform?

Participant:

I found it very good because the background was black—I don't know if that's the site itself. The text had a larger title in bold. I managed to read it easily.

Researcher:

And what device did you use? Was it the tablet?

Researcher:

I used my phone.

Researcher:

And what model is your phone?

Participant:

It’s an iPhone 14.

Researcher:

Right, so you probably used the Safari browser.

Participant:

Yes, it was Safari.

Researcher:

Did you encounter any difficulties reading the cordel online? Anything unusual?

Participant:

No, everything was great.

Researcher:

Did you need to zoom in on the text?

Participant:

No, I didn’t need to. I think it’s because my phone’s font size is already large and adjusted.

Researcher:

Okay, so the site adapted to your pre-configurations.

Participant:

Yes, my phone is fully adapted.

Researcher:

Do you remember the name of the first work you read?

Participant:

Wait, I have the name here: As Quatro Órfãs de Portugal (The Four Orphans of Portugal).

Researcher:

Then you found another work, about the gunslinger, right?

You downloaded it, and the download process was easy—no problems there?

Participant:

Yes, no problem—just opening it was an issue.

Researcher:

When you tried to open the work, was that also on your phone, or did you use a different device?

Participant:

It was on my phone. I even sent it to a group I have for myself because I usually open PDFs directly in WhatsApp. I tried opening it, but no. With PDFs, I can open them on WhatsApp, but not this format.

Researcher:

Other participants using iPhones managed to open it.

For instance, another participant, who has a different condition—total blindness—uses a paid app.

I can't recall the name now, but I can send you some names of apps that open EPUB files on iPhones via WhatsApp later, in case you're interested or curious.

Participant:

That would be great. Thank you.

Researcher:

I had a question about which format you preferred—the web or EPUB.

But since you couldn't open the EPUB, I think it's unnecessary, right?

Participant:

Yes, but the web format was satisfactory.

Researcher:

Going back to when you were 14 years old, how would you compare your experience of reading online versus physical cordel?

Participant:

Well, with physical cordel, as I mentioned, my condition is progressive.

So, when I was 14, even though I had very high myopia, I managed to get by. In school, I could still do my activities.

But it was around 18 or 19 years old that I began struggling with basic tasks, like writing in a notebook. So back then, reading physically was fine.

But nowadays, I don't think it would be as easy, depending on the font size.

Researcher:

In my research, during the literature review, I couldn't find many reports of accessible "cordels". That's why I also asked for your opinion about whether it was common or not. Generally, the research suggests accessibility only happens in specific contexts—at specific fairs where Braille cordels are produced, or people narrate cordels at events. It's not common to find cordels in formats other than physical ones.

Participant:

That's true.

Researcher:

If you had to give me a suggestion for the project, for the e-Cordel platform, whether it's the web part or even the chosen format, what's something that you think might have been missing or could be improved?

Participant:

Well, thinking about people with more advanced disabilities, I would increase the font size on the site a bit. I'll send you a screenshot of how it looks for me. I can read it, but thinking of others, I think slightly larger text would make it even easier.

Researcher:

Anything else? Any other suggestions?

Participant:

Not at the moment.

Researcher:

Perhaps another format?

Participant:

I can't really think of another format.

Researcher:

Alright, that's all for now. Those are all the questions I had to ask…

Goodbye, thank you.

Participant 2

Code: P2
Age: 35
Gender: Male
Light perception: No
Impairment: Blindness

Researcher:
Hello! This is a semi-structured interview, so I have a set of questions, but I may ask others as we go, depending on how the conversation flows.
The interview is divided into two parts. First, we'll revisit some of your responses from the pre-questionnaire. Then, we'll focus on your experience reading works, both online and offline…
Participant:
Yes, sounds great!
Researcher:
Great! To begin with your pre-questionnaire, I noticed you marked "zero" for visual acuity—no light perception. Could you tell me a bit more about your diagnosis?
Participant:
I have a genetic condition that runs in my family: severe myopia. It has been passed down from my great-great-grandfather through to my father, and now to me. I was born with it, and it gradually worsened over the years. I lost the sight in my right eye at age 14, and by 16, my left eye went blind due to a detached retina. In 2014, I discovered I had a detached retina in my right eye as well, and just a month ago, I learned I have glaucoma in the same eye. So, it's a combination of myopia, detached retina, and glaucoma, all of which are hereditary conditions in my family.
Researcher:
So these conditions are genetic, right?
Participant:
Yes, they're all genetic. My grandfather was blind, I have an uncle who's blind, another uncle blind in one eye, and a sister who's also blind. It's in our genes.
Researcher:
How did you hear about this research?

Participant:

A friend of mine, who's a researcher sent me the link. We've worked together and even taught in the same municipality. I'm also involved with assistive technology, and I research technology for students with disabilities in higher education…I looked it over and liked the idea, especially because of the Cordel tradition and how it connects to Brazilian resistance and history. Keeping Cordel alive, especially in Portuguese teaching, is important to preserve this cultural form.

I also love the poetic style of Cordel and the history behind it, so I wanted to contribute.

Researcher:

That's great! I'm happy to have you on board. Now, regarding technology, how would you describe yourself as a technology user? Would you consider yourself an advanced user who can effectively use assistive technologies for daily activities, or are there still some challenges or areas you're still learning about?

Participant:

I'm not exactly "learning." The main issue I face is the cost of certain equipment and software. There are programs I would love to have, but they're too expensive—costing anywhere from R$10,000 to R$15,000.

But with what I have, I manage just fine. I use my laptop, NVDA screen reader (which is free), and Balabolka—a program that turns text in PDFs into speech. I rely heavily on those.

Researcher:

Sorry to interrupt, but could you repeat the name of the program you use to convert text to audio?

Participant:

Sure, it's Balabolka. It lets you copy text from a PDF or website and paste it into the program. You press F5, and it reads the whole text aloud. You can even save it as an audio file, like an MP3, which is very helpful.

My main problem is with websites that use images. Screen readers can't interpret images, so I often don't know what's there. Some sites also don't fully work with readers—some sections get skipped because of how the website is coded. As a technician, I know that this is a result of the HTML code, and if the code is not set up properly, the reader can't access certain parts of the site.

Researcher:

I understand. Have you ever used or heard of the EPUB format before?

Participant:

No, I hadn't heard of it before. When I downloaded the file, I thought, "What is this format?" I had no idea.

Researcher:

That's actually the format I chose for this project. It's designed to be more flexible than PDFs… But I've realized that not everyone is familiar with EPUB or has the right tools to read these files.

Participant:

That's what happened to me. When I downloaded the file, I chose a "Cordel" poem—"A Filha do Pescador" by Leandro Barros. I tried opening it, but it asked me which program to use. I tried with Word and PDF readers, but nothing worked. Then I remembered Balabolka, and when I opened it there, it worked fine. I was able to read and listen to it.

Researcher:

Got it. One last question from your pre-questionnaire: You mentioned you've heard "Cordel" before. Can you tell me about the circumstances in which you've encountered it?

Participant:

Yes, I've done theater. In some plays, we included "Cordel" texts. A friend would read them to me because I didn't have a laptop back then.

Recently, in Salvador, I attended a performance where someone recited a "Cordel" and played guitar. It was beautiful—I really connected with the story.

But most of the time, I read all my files in PDF format, on my laptop. I don't use Braille because I don't have the space for it. Everything I read is digital.

Researcher:

Do you find accessible versions of "Cordel", like in Braille or audio format? Are they common?

Participant:

Unfortunately, it's not common… the culture is kind of fading away, especially in my city. I miss the "Cordel" literature—its poetry and stories. I'm a teacher, and I often start my lessons with a verse, a poem, or a song to get students thinking. I encourage them to reflect on their paths and choices. I think it's an important way to engage them.

Researcher:

From what I've researched, I found that accessible versions of Cordel are mostly available during fairs and exhibitions. That's part of why I'm motivated to explore accessibility in this area further. Cordel became part of Brazil's cultural heritage in 2018, yet many people still don't have easy access to it.

Participant:

Exactly. For those of us with disabilities, it's even harder. I also do consultancy in audio description, where a friend writes the descriptions, and I review them. The key is to be very clear and objective in the descriptions—not to interpret them, but to describe what's there.

Researcher:

Right, so you focus on describing without adding personal interpretations.

Participant:

Exactly.

Researcher:

Now, regarding your experience with the platform: You mentioned you read "A Filha do Pescador" online. Did you access it on your computer?

Participant:

Yes, I used my laptop.

Researcher:

Which browser did you use?

Participant:

Google Chrome.

Researcher:

And you were using NVDA as your screen reader?

Participant:

Yes, that's right.

Researcher:

How was your experience reading the "Cordel" on the platform?

Participant:

It is nice. I read it. I liked it, it caught my attention. "A filha do Pescador" It's the title… I read it calmly. I read it twice. I don't know if there is any image. I kept trying to see if there was any image. I don't know if there is.

Researcher:

I think there is one image.

Participant:

Cordel’s xilogravura I don't know if it's an image.

Researcher:

That's the image. It is the cover of the cordel, the woodcut. And now that you consult on audio description, maybe I could ask you what the best way would be to present this to the user.

Participant:

... when we don't have an image description, we get lost. For me it could be an image, I'm not sure. The reader doesn't say an image, doesn't say anything. It only says the topic, the title. But the rest, the site is accessible.

It didn't crash. The reader read it calmly. I don't know if there are some images inside the text… so I don't know if there is or not.

Researcher:

There is only one image, which is the “xilogravura”. The cover of the cordel. It could have a better description indeed. It's not to say that it was an image.

Participant:

Yes, the website was easy to access, it was well explained. I had no trouble.

Researcher:

Good. It was also easy to find the second work to download? It was easy to search?

Participant:

It was because I read the entire recommendation. I had listened to the audio instructions, step by step. I have a notion of computer science.

So I had no difficulty at all. I downloaded it, I went there in download folder. I saw the file. Only then I found it strange. I couldn't open, neither with PDF nor with Word. Then I had to open it with Balabolka, and again I had this impression that there was an image above. But balabolka didn’t say anything either. But I was able to read... I didn't have any difficulty.

Researcher:

That's good. What if you had to choose between one of the two?

The web version or the EPUB file with Balabolka? What was the best experience?

Participant:

I like having the file… I've got a lot of books here. Because...
It's on the website, but what if the site goes down? If want read it again I have it saved. If I want to pass it on to someone. I have it downloaded. Did you understand? I could recommend it to someone…
I wish I could have it on paper but there is no space… so I prefer everything digital.
Researcher:
Can you print Braille at home? Or at work?
Participant:
No, not in my house. A Braille printer costs R$30.000.
Researcher:
Really? Wow!
Participant:
It is. Some printers may cost 4, 5 thousands, or 6 thousands.
Apart from the paper. Because paper does not sell like sheets.
It is like a tube. You have to have someone to cut it to make the size you need… And over time, with the coldness, the Braille dots decrease in size.
Researcher:
I didn't know that. That is, even if you have the work in Braille, you need to preserve it...
Participant:
Yes. And you can't put weight on it. You have to store it vertically. The book has to stand upright… Then I prefer not to have it, right? I put everything in the PDF, on the computer, on a pendrive. For me it is better.
Researcher:
So, I'm going to summarize your last answer here as follows and you should tell me whether you agree or not. Overall, both experiences on the site and with the EPUB were satisfying, to the point that they are equivalent, but you rather to have the file to use in the future, if necessary.
Participant:
Absolutely. Yes.
Researcher:
Give me a suggestion to improve this project, it could be either about the web part or even this second part of downloading the work. Maybe something that you felt it could be better or missing? Anything.

Participant:

The audio description image issue. Every image that is placed on the website or in the PDF, must have it…

Every image, in my understanding, has to have an audio description. If those who have a good sight are seeing it, we also need to know that it is there. And we need to know what's in it. That's all, the rest is fine.

Participant 3

Code: P3
Age: 46
Gender: Male
Light perception: Yes
Impairment: Blindness

Researcher:
I'm going to ask you some questions about your experience, what it was like reading the "cordels" and also about the pre-questionnaire you answered in the first phase of the survey. So, tell me first, how did you find out about the research?
Participant:
It was a friend who sent it to me by WhatsApp.
Researcher:
One of the main questions in that questionnaire was about your visual acuity. You scored 1, on a scale from 0 to 7? What is your diagnosis, what is your ability, could you describe your visual ability?
Participant:
I have severe low vision, so I can only perceive light and shadow.
Researcher:
Okay. And then, in the questionnaire you said that you usually read electronic books, and download over the internet, and also know the EPUB format. How is it, in general, in your experience, how do you consume these materials? Do you use a screen magnification or only through the screen reader?
Participant:
Only screen reader. 100% of the reader. Both on the computer and on the cell phone.
Researcher:
You already knew "cordel" literature and had already read a Cordel too, how was it, it was people who recited a cordel for you on that occasion?
Participant:
Yes, yes, exactly.
Researcher:

How common is it to have an accessible Cordel?

Participant:

I don't know, I've never had contact with it, not in these more classic formats Braille, with audio description… But take into account that a declaimed “Cordel” is still a form of accessibility.

Researcher:

But even within this category of narrated Cordel, it it common to have fairs or events with it?

Participant:

More punctual, as far as I know, more punctual, but I believe that here in Brazil, in some places, it is very common for you to have access to Cordel in squares, in streets, in events, especially in the northeast, because I live in… but in the northeast region I believe that this is much more common.

Researcher:

So, tell me, the first task of the second part was to read a cordel of your choice online, and I wanted you to tell me if you were able to read or listen to the cordel, how was the experience?

Participant:

I was able to read it, I had no difficulty at all. Pretty easy.

Researcher:

And what device did you use? A computer, a tablet, a cell phone?

Participant:

I read on the computer, the computer and the screen reader is NVDA.

Researcher:

And what browser was used?

Participant:

Google Chrome.

Researcher:

And was it easy to navigate the platform?

Participant:

It was, but you have to take into account the level of knowledge of the user, I consider myself an advanced user, I don't have the difficulty to use the screen reader. I don't know if you know, but we work with several shortcuts, for you to navigate a website, especially a site you don't know, you have to know the shortcuts, so you can jump from

one area to another, jump through the links, etc. It requires some experience, maybe for a beginner user it's not so simple how it was for me.

Researcher:

In the pre-questionnaire I can see that you already know about the ebook formats, some participants did not know the EPUB format for instance…

Participant:

It is not very widespread in Brazil.

Researcher:

And, in your opinion, why does this happen? Maybe companies don't publish materials in this format?

Participant:

Perhaps… It's not as popular a format as PDF, for example. PDF is much more popular than EPUB.

Researcher:

And I've heard feedback that, in some cases, people with visual impairments could even prefer a TXT, for example.

Participant:

Absolutely.

Researcher:

Is this valid in your experience too?

Participant:

Totally.

Researcher:

And why would it be an accessible format? Because of its simplicity? Because it is easy to open this file?

Participant:

For screen reader users. Because it doesn't bring formatting. Formatting gets in the way of reading with screen reading. Reading with screen reading is a little more truncated. And when you read the TXT, the reading is more fluid. There are no interruptions, there is no pollution of images, links, other things. So we use TXT a lot. Many times we copy a text from a website, paste it into the notepad to get rid of the formatting and to have a more fluid text, and a faster reading.

So, for sure, TXT is an interesting format. When we talk about accessibility, we have to think in accessibility for all people, Not only for people with disabilities. TXT doesn't

have a visual appeal. So this is a problem for people who do not have disabilities. So we have to balance this. That's very important. This balance is difficult, right?

Researcher:

Exactly. For my research, I chose the EPUB format by the amount or possibilities that I could work with this format… It was also a surprise for me to have feedback that said that TXT could have been a solution…TXT could also be a simple way to promote accessibility to cordel. So it's a very interesting feedback.

Participant:

But the images would need to be accessible as well.

Researcher:

Yes, yes. On the web, the images are... I have the alt attribute to have the image description of each work.

My next question is about the downloaded cordel. If I'm not mistaken, you couldn't download the cordel the first time, right?

Participant:

Not at first, because there was an error. When I clicked to download, that error page, internal error 505 appeared. Even yesterday, when you sent me a message on WhatsApp, I logged back into the site, and on the first attempt I got the error again. But then I persisted, Then I managed to download it.

Researcher:

OK. So I need to check the logs and see what the problem was.

Participant:

But then I managed to download even more than one.

Researcher:

OK. So you encountered a problem to download and not a problem to find the download option.

Participant:

No, it was the problem of the website itself, that he was falling into an error screen.

Researcher:

Okay, alright. I apologize for that.

Participant:

The first time I tried several “cordéis”… but I got the same error. It may be an issue with browser too. I haven't tested it in another browser.

Researcher:

Okay, okay. But then, what next? When you finally managed to download the cordel. Were you able to read the EPUB file?

Participant:

I was. Then I read it on my cell phone.

Researcher:

What device did you use? Can you tell me the version, model of the cell phone and which application was used?

Participant:

The cell phone is Samsung, I use Android, and the screen reader is the Talk Back, and the app I used is Lithium.

Researcher:

And you usually read EPUBs on your phone?

Participant:

I don't read it as often as other formats, but I've read it. I even have books published in EPUB.

Researcher:

Okay, good! As I said earlier, some users did not know the format and they had no app for this.

Participant:

Some may use it, but they do not know the format.

Researcher:

Yes, in some cases, they had probably never used it, or at least not on the device they chose at that moment because they didn't have a proper app to open the EPUB. So, my question comes in this sense. How was the experience of reading the EPUB versus the experience of reading on the web version?

Participant:

Better the web version.

Researcher:

Why?

Participant:

More fluid, more peaceful. The screen reader read the EPUB but it seems to be more truncated. You have to scan, that gesture of dragging from left to right or from right to

left, until you find the text. On the website, it seems that it has a better fluidity. On my computer.

Researcher:

And overall, did you feel that this lack of fluidity in the EPUB compromised the experience or was it still possible to consume the cordel?

Participant:

It was possible to consume, but it still compromise the experience. If you are a slightly less patient person, you would give up already, maybe. There are people who don't have much patience, they don't have much contact with technology, they will soon give up. We need to be as assertive as possible.

Researcher:

And what would be a suggestion to improve the project?

Participant:

An audio version. A streaming one. Where I can click on the player and listen to the audio on the website itself. And then you could even, in this recording, have background music, sound effects, which is much more attractive. But the player have to be accessible as well.

Researcher:

Yes. Thank you. So I'll try to make a summarize everything...

You managed to complete all that was proposed and rates the web experience better than EPUB by its own fluidity, right? And in general, in your experience, in your life, accessible cordeis, even if narrated or regardless of the format, are rare only in specific situations, right?

Participant:

Yes.

Participant 4

Code: P4
Age: 22
Gender: Male
Light perception: Yes
Impairment: Low vision

Researcher:
I have some questions for you about the whole process… first I just wanted to review the answers from the first phase, right?
You evaluated your visual acuity as a 4, right? On a scale of 0 to 7, if I'm not mistaken, you scored it as a 4. What is your visual condition diagnosed as it is today?
Participant:
It's low vision, I have central retinal degeneration, so I have little central vision and peripheral vision is preserved, so my low vision is defined by visual acuity.
Researcher:
Okay. But you can read on the tablet with the zoom, increasing the text size, using the tablet generally, right?
Participant:
Right.
Researcher:
And do you usually read a lot or most of the time is it the screen reader that gives you the information you need?
Participant:
Generally, because of the screen reader bugs, I prefer to zoom in. Text-to-speech is usually not good, it's too slow, so I prefer to zoom in. When I can't zoom in, I take a photo and zoom in on my cell phone.
Researcher:
So what was the device you used, was it the tablet too, as was said in the first questionnaire?
Participant:
No, in this case I used the cell phone.

Researcher:

Okay, so you usually use both, is that it?

Participant:

Right.

Researcher:

Okay, and on mobile you also zoom in to be able to consume the material, right?

Participant:

Yeah, the feature I use both.

Researcher:

Okay. And what is your cell phone? Do you know the model?

Participant:

The model is Xiaomi's Poco F5.

Researcher:

Okay, so it's Android, isn't it?

Participant:

Yes.

Researcher:

Okay, right. And it was this cell phone that you used to read the first work on the e-cordel website, without having to download it, right?

Participant:

Yes.

Researcher:

And were you able to read the whole work?

Participant:

Yes I was.

Researcher:

Do you remember what the work was, that first one you read?

Participant:

No quite, I read other cordels after that…

Researcher:

That's good. So tell me like, how many “cordeis” were you able to read on the platform?

Participant:

On the platform I read only the first one, and another one that was about a bully, I don't know. And then I read some more, but it wasn't on the platform.

Researcher:

Where?

Participant:

On the internet.

…

Researcher:

Oh, I see. So you already look for “cordéis” online to read, is that it?

Participant:

Yes, just because I'm usually using YouTube, there's a channel that “he” reads. Then I listen when I'm doing something.

Researcher:

OK. And can you tell me the name of the channel, something that helps me find it?

Participant:

The name of the channel is “Literatura de Cordel, Imagens of the Sertão”.

Researcher:

I didn't know it, that's good. Does it help you to consume the cordel in another way, right? Because then you can also maybe include it more easily in your routine, right? While you're doing something else, you're also listening to the cordel, right?

Participant:

Yes.

Researcher:

How interesting.

Participant:

The youtuber set a goal of recording a thousand cordel novels for a year. So I think this goal has already been reached and surpassed…

Researcher:

Wow, that's cool. I need to know this channel then. I didn't know it.

Participant:

The man's name is “João Carlos Espíndola”.

Researcher:

Okay, I'll look for it. Thank you very much, I didn't know it. So what was your experience of reading the cordel, in the e-cordel, this online cordel? What do you think?
Participant:
I liked it, because it brings not that mechanical thing of the PDF, but something that shows even the movement of the page, right? And also the platform has a good variety of cordel that I didn't know.
Researcher:
Okay, that's good. We have more cordel to publish as well. And the last part consisted of two tasks, right? One was to read a “cordel” on the e-cordel website and another was to download the “cordel” and read it offline. You managed to complete both phases, right?
Participant:
Yes, both tasks.
Researcher:
And were you able to open it normally on your cell phone?
Participant:
Yes, my cell phone also opened the Text in Voice option. But the text in voice I didn't think was very good, because he doesn't pause and he's still very mechanical. But I liked it.
Researcher:
And in which application you opened the cordel that was downloaded?
Participant:
Envision Eye.
Researcher:
Envision Eye? Ok, so it's an Android application, Envision Eye, and in this application you can open several materials, right? Like PDF, EPUB…
Participant:
Yes.
Researcher:
And one more thing, Did you already know this format of digital book, the EPUB?
Participant:
I didn't know it.
…

Researcher:

And if you had to compare the two experiences between reading the cordel on the web platform versus reading the cordel that was downloaded to your device. How would you compare that?

Participant:

If the quality of the narration was good, I would say that I liked the downloaded cordel better… because it easier to zoom in. When I tried to read the downloaded one I left only the voice since the text was small. I didn't try to read. For the online one I used the screen magnification and I was able to understand the work much better.

Researcher:

Okay, right. But is it also possible to zoom in this app, on the Envision Eye?

Participant:

I think so.

Researcher:

So, just to clarify, on the web it was easier, because it was easy to enlarge the text and follow the text. And for the downloaded one, the text seemed small, you chose to listen to it and then the narration was not exactly what you were expecting. Could it be so?

Participant:

Right.

Researcher:

OK. Got it. So, to finish, I wanted you to give me a suggestion for this project… Something that is a priority for you.

Participant:

So, I think the priority is the voice issue. Better text-to-speech conversion and synchronization. Pauses, and everything.

Participant 5

Code: P5
Age: 31
Gender: Male
Light perception: No
Impairment: Blindness

Researcher:
So, in your pre-questionnaire, you answered that the sensitivity of light was zero, right? What is your diagnosis in this regard?
Participant:
I have total blindness.
Researcher:
Is this situation from childhood or was it something that happened later?
Participant:
So, I had conjunctivitis at the age of five… Then my grandmother took me to the doctors and they were giving me eye drops, right? And this eye drops burned my retina… And at the age of eight I lost on the right side, and at the age of nine I lost it completely on the left side and on the right side. I even had a transplant but then I lost the rest I had. I had visual residue, like, I could see light, the TV on, right? But I totally lost it.
Researcher:
And you told me you had some technology skills, and you had bought a Kindle too, right... Have you been doing this for a long time?
Participant:
I started entering the world of technology since 2009, right? When a teacher, who gave braille, introduced me to the DOSVOX system, and later I bought my own notebook, and I started to learn how to work with Windows, with NVDA screen reader, with JAWS. And since then I've been learning. I did some HTML, Python...
Researcher:
Did you even program too?
Participant:
Yes.

Researcher:

How interesting! Something that caught my attention in the pre-questionnaire was that you had answered that you had already read a cordel in Braille, right? If I'm not mistaken you wrote "In the 7th and 8th grade, I read some cordels in Braille". That was the answer you added.

Participant:

Right.

Researcher:

This caught my attention because in my research I didn't find many fonts cordels in Braille. And the feeling I got is that this kind of cordel is produced only in the context of a fair, an event. So I wanted to understand if your school already fostered this type of accessibility or was it a more localized event?

Participant:

Yes, there was an event where we made cordels to compete, you know, like the Olympics. And then some cordels were printed in Braille. But it was really handmade, you know? It wasn't like that, I went to the library that I found a cordel in Braille...

Researcher:

Interesting. But then who printed the cordel in Braille? It was the school itself, the organizers of the event, is that it?

Participant:

The teacher. The Braillist teacher.

Researcher;

So you had a dedicated teacher for that.

Participant:

Right.

She stayed in a room, giving support, answering questions we had, such as mathematics, English, Portuguese…

Researcher:

Okay, that was the feeling I had. What I found was that some fairs or some events produced the cordel in Braille, or they promoted reading sessions, or even recorded someone to distribute this material in a more accessible way.

Participant:

Yes, but we only had access because we were having this event, the Olympics, that we were competing.

Researcher:

Sure. And apart from this event, or this moment in your life, you have never found a cordel in Braille again?

Participant:

In high school. We were studying about the cordels and it was also printed, but it was more like that.

Researcher:

It was also printed for that occasion.

Participant:

Right.

Researcher:

And also something that caught my attention was that you already knew the EPUB format, right? Some participants did not know… they were unable to open the file.

Participant:

It's like I said, right? You needed to have a program to read the file, both on your cell phone and on your computer, right?

Researcher:

Yes. And on mobile you used the iPhone, right?

Participant:

Right. With the Voice Dream app.

Researcher:

Is it for various book materials, or digital materials, or is it just like voice over that goes on top of the screen reader, for example?

Participant:

No. It has a reader of its own. It reads any type of extension, pdf, docs, txt. If you put an mp3 in, it plays.

Participant:

The app requires a subscription. And it's quite expensive. R$ 300 per year.

Researcher:

Now let's think about the e-cordel website, which is where you read the first works. You told me that overall... And now I'm going to try to reproduce your experience, but correct me if I say something wrong. You were able to read the work and navigate the platform, although the image, which was the woodcut (xilogravura) of the cordel, that

was between the title and the text, was not read correctly or represented to you in the best way, right?

Participant:

Right. I only saw this difficulty of appearing the image and not having the self-description of that image. But browsing a website was smooth.

Researcher:

Interesting. I did some tests, it was a static test on the platform, I ran an accessibility program. It does not recognize all accessibility problems, but it recognizes the most critical ones. And the image, or all the images have an alt, an HTML attribute,

Participant:

The screen reader read random letters…

Researcher:

Okay. And in your experience, the web part was on the iPhone using Safari and VoiceOver, right?

Participant:

Right.

Researcher:

Ok, I think I can reproduce here, and I'll test it with the iPhone as well
and see if I am able reproduce this same behavior.

Participant:

Which screen reader did you use to test?

Researcher:

My tests were different, because I do the static test, which is a tool of the Chrome browser that tells me which components could have a better description, or for example the alignment of the titles, if it is in the right order. So I haven't tried it with VoiceOver alone…

So the next question, which is what you already answered me, it was easy to download the work, you found the work I had suggested…

Participant:

Yes, I downloaded it from both iPhone and Mac and it was smooth.

Researcher:

And with the EPUB, the screen reader found something strange, in the same way as the image, for example, that was on the web?

Participant:

No, the EPUB was fine.

Researcher:

What was the best experience in your opinion? Web or EPUB?

Participant:

I prefer the file, not because is EPUB, but because I can apply my custom configuration. In the browser, I have to change the voice and keep the screen unlocked. With the file I can use an app of my choice already customized, in this case, I used VoiceDream. With this I can read at my preferred speed, change voices, and highlight words, beyond being able to read with locked screen and do something in between.

Researcher:

So, you also gave me a suggestion of having the same work in different formats, such as TXT, doc or even PDF.

Participant:

Yes.

Researcher:

Do you have any other recommendation? Also what did you think of this idea of having Cordel in a digital format, which could be better or not?

Participant:

I thought the initiative was cool. I liked it, for me it was super smooth, the site is intuitive. I think the only thing missing was this issue of having more extensions, because there will be people who don't have programs, don't have space on the computer, on the cell phone to install other things, and I think a PDF, a TXT would be a great option.

Researcher:

In your experience, people with visual impairments know EPUB or they are more familiar with these more common formats?

Participant:

The majority are used to TXT or PDF, and they would definitely have difficulty downloading.

Researcher:

To download or to read?

Participant:

To download the file itself and browse the website. Usually people turn to other things instead of the website.

Researcher:

For instance?

Participant:

Drives, Whatsapp, book groups.

Researcher:

That is, the community itself, in your opinion, it is more likely for people to interact with each other to find accessible materials than use a specific site?

Participant:

Exactly.

Usually the screen reader does not behave well on a website, and then people have difficulty to navigate, the reader loses focus, or the person does not have much skill and ends up going to an Whatsapp group that shares books. I myself participate in several groups.

For example, the groups I am in, when I share the EPUB, or another format that the people do not know, they ask to transform it into TXT or PDF… they really don't adapt to the EPUB format.

Researcher:

I understand. It's a curious insight to me, by the way, that's good, I'm happy to know that too.

Participant 6

Code: P6
Age: 33
Gender: Male
Light perception: Yes
Impairment: Color blindness

Researcher:
In the first question about visual acuity, you chose normal vision without corrective lenses. But you have color blindness, right?
Participant:
Yes, but it is not diagnosed. I've done several tests on the internet… once I took some exams and the ophthalmologist who did the eye test said I had probably daltonism, but the exam to confirm is only done in another city.
Researcher:
Ok, but does it prevent you from reading or has it already prevented you from reading something online or not?
Participant:
No, no, no. It's depends on the color tones, you know?...
Researcher:
Okay, and, on websites, in general?
Participant:
Overall, so far, never.
Researcher:
Or at least if you recognized a different color, it does not hinder interaction with websites on a daily basis, right?
Participant:
Exactly.
Researcher:
And how about reading a book?
Participant:

Not for books, because it's usually black and white, right? Or the other way around. The black page and the white letters or the white page with black letters, so that color contrast is not a problem.

Researcher:
Okay. At the end of the questionnaire, there was a question about the satisfaction with electronic material, and you scored 3 on a scale from 0 to 5, where 5 was the most satisfying. So what is not satisfying?
Participant:
Look, it depends on the font. It depends on the reader, on the book. If I can take notes, and more in that sense, you know? That's why I chose 3. Actually I was in doubt about this question, right? What would it be the satisfying level to me?
Researcher:
In your case, you don't have severe condition. You are not really impacted by any visual impairment, right? In other words, here it was more directed to someone who, for example, couldn't really interact with this type of material. But in your case it seems you need advanced features, right?
Participant:
Yes, it is, exactly. But it has no correlation with visual impairment.
Researcher:
Sure. So, have you never read a cordel before?
Participant:
No. If I did it was a long time ago. Maybe back in school as a child.
Researcher:
So, for the second part, which was about reading two cordels, one online on the e-cordel platform and other offline. Did you manage to do both tasks, right? Read the two cordels.
Participant:
Correct. I read one, then I read one of my choice, right? Then I read the one about the girl? I downloaded the e-cordel and read it on my cell phone.
Researcher:
Sure. But you didn't download what was specified?
Participant:
It was not that one of the girl?

Researcher:

I think it was one about the gunman.

Participant:

Let me see.

Oh, okay. I read the girl one on my own. And then I read the one you suggested… I read one online and the other I downloaded.

Researcher:

Okay, that's enough. That was just a recommendation because it's a smaller one. There was nothing very specific about it that would impact the research. Then where did you read the online one? Like the device, the browser?

Participant:

It was through the browser, but through the cell phone.

Researcher:

Okay, tell me the model of the cell phone and the browser.

Participant:

It is a Samsung S21 FE. And it was through the Edge browser.

Researcher:

Okay, but then in your case, for example, the colors of the cordel, that green on white didn't cause you any problems?

Participant:

No. It was fine.

Researcher:

And do you think the screen lacked contrast? Maybe?

Participant:

No.

Researcher:

How about the EPUB?

Participant:

The EPUB was better because it was divided into pages, something that the site doesn't have, right? On the website you scroll down there, right? And with the EPUB it is easier to zoom in, right? …

Researcher:

And where did you read the EPUB?

Participant:

I read on Google Play Books.

Researcher:

And did you already have Google Play Books installed?

Participant:

Yes, I had already installed it. And I have Kindle App and Google Drive, but the only one that gave me the option to open it was Google Play Books.

Researcher:

So, what about the download page? Did that download button have enough contrast?

Participant:

Yes.

Researcher:

I'm asking this because I used Lighthouse to test the accessibility and one of the finds was that that download button could lack contrast.

Participant:

Yes, it really lacks on white. But as I opened it on my phone… at night, my phone default mode is dark, right? Then the dark mode gives a good contrast, right? The green stands out in the black, right? But yes, with it loses its prominence.

Researcher:

I understand. Then it changed to the dark theme.

Participant:

This was better highlighted.

Researcher:

Compare the experience of reading web versus EPUB. And then, if you had to give any suggestions, something that you missed, or even these other more advanced features, what would it be?

Participant:

On the web I don't have an option to increase the text, for example. It's not natural. I'll have to use features from the browser itself, right? Keep hitting Ctrl plus…

Researcher:

But then you were typing Ctrl plus? Did you read it on the computer?

Participant:

No, I'm on the computer, right now. But on my cell phone I'll have to zoom in, right? I didn't even test it, right? I don't know if it works.

I want to have a clear option to increase the font size there. And also, I don't know, maybe some button to change the contrast. That would be interesting, right? Because it only has the option of light and dark mode, right?

Regarding EPUB, I don't think there's much, at least to me. There's not much to add because, as you said, I don't have a visual impairment. It's quite natural for you to zoom in and such…

Researcher:

And any other suggestions?

Participant:

I think this is it.

Participant 7

Code: P7
Age: 32
Gender: Female
Light perception: No
Impairment: Blindness

Participant:
… last year I was at the Biennial, at the Book Fair, and I went to a place that had several cordels, and I talked a lot with the boy about the importance of having a cordel in braille… I did, because if we don't have it, I think we should claim it.
Researcher:
Exactly, exactly, I agree with you 100%.
Participant:
And also because usually in these book fairs there are books in braille, as I went almost at the end of the fair this time, I couldn't see books in braille, but usually I see some books, but the cordel in braille I have never seen.
Researcher:
In my research too, I did not find many reports published in scientific articles about braille cordels. What I found, and what appears to be the reality, including from your report, is that the works are printed in braille on very specific occasions, for example, one of the participants in the study has already read some braille cordels at school…, or some events promote the reading of cordel or even just the audio…
Participant:
Oh, I've never seen it in audio.
Researcher:
Okay, it's good feedback as well, because it reinforces that what I've read, what I've researched, unfortunately it is the reality today.
Participant:
And it's an interesting reading, but unfortunately, for us visually impaired people there is not much, at least not today.
Researcher:
Exactly, that's the whole point of the research. And I'm glad you touched on that point.

Okay, so, the first thing I wanted to ask you is how did you find this research? How did it come to you?

Participant:

So, a friend of mine sent it to me, he said that you put it in a group. Then he sent it to me, I decided to participate.

Researcher:

Good, that's right, thank you. So, in the first questionnaire, there is a specific question that is about your visual acuity. You selected zero, which is total blindness with no perception of light, right? What is your diagnosis? Can you tell me that?

Participant:

Retinal detachment. It was from birth, I was born this way, I was born without sight.

Researcher:

Okay. And in this same questionnaire, towards the end, there is a question about whether the participant usually reads e-books, you marked no, and then the questions that were related to that were left in blank. Since you don't have the habit of reading electronic books, the other questions didn't make much sense, right?

Participant:

That's it, right.

Researcher:

Why you don’t read electronic books? Or for you, in this case, is it a personal option or is it something, some difficulty that you encounter?

Participant:

It's a personal choice, also because I like PDF books more, these electronic ones, audio book, I have a certain difficulty for, like this, because they take a long time, the reading is very slow, I'm kind of fast-paced, so I prefer to download a book, read it in PDF, I think it's faster, but I also don't have much of a reading habit.

Researcher:

Okay, and how is it, in the case of a PDF, what do you usually use to read PDF books?

Participant:

So, I usually read on my cell phone, with a program called VoiceDream, I download and put it to this program, So if someone sends me the book too, I put it in this program, in this application and read it.

Researcher:

Right, what's your phone?

Participant:

It's the iPhone 12 mini.

Researcher:

Okay, got it. And there were two questions about the cordel, if you already know the cordel literature, and if you have read or listened to a cordel before. On what occasion did you read and/or listen to a cordel?

Participant:

Well, I saw a lot in school, when I was a kid, and in some things, like so, book fairs, some bookstores that have some cordel books, someone has already read a piece to me. In the event I told you too, which I talked to the poet. But it's not such a common thing.

Researcher:

Okay, have you ever read a Braille cordel?

Participant:

No, none, I have never found one.

Researcher:

So, in this case, I could say that, until today, your contact with the cordel was the cordel narrated by somenoe, is that correct?

Participant:

Yes, other people reading to me, not in audio, but other people, families, friends...

Researcher:

Did you managed to complete all the steps of the research, right?

Participant:

Yes, I did, and very quickly by the way.

Researcher:

Really? That's good.

Participant:

Yes, for me it was very easy to do it.

Researcher:

And you used the same device, the iPhone mini, with VoiceDream?

Participant:

Yes, I did everything on the iPhone, but I downloaded the second work as required.

Researcher:

Exactly. So, and you also used the iPhone, right?

Participant:

Right.

Researcher:

And in the first part you probably used Safari… or did you use another browser?

Participant:

Safari.

Researcher:

So, tell me with your words your first impressions of the platform, what you thought, what you didn't find, what you missed or not…

Participant:

For me it was super accessible, I quickly managed to find an interesting cordel and opened it, read it without any difficulty.

Researcher:

And when you read the first work on the platform, did you notice something strange? For example, when the screen reader announced some element, some image, for example, or something of that sort?

Participant:

No, I didn't notice anything strange, the screen reader read it calmly, it was easy to read.

Researcher:

And did you find the work suggested for download?

Participant:

Yes, I did. About the gunman…

Researcher:

Exactly. Then tell me how it was step by step, from downloading the work , opening it… If you want to be more detailed in your answer, feel free to do so.

Participant:

So, for me it was easy to open and lower the cordel, I would only have one suggestion. Instead of me having to go into the cordel page and download it, I think it could… download it, without having to open it. But it was not difficult to me to have to do it, just for agility, but it was easy. I opened it, I saved it, I read it, everything was fine.

Researcher:

So as soon as you identify a cordel you are interested in, it should also have the option to download it without having to go to the next screen, right?

Participant:
That's because we wouldn't need to open the work to download it. But it wasn't difficult, it's just a matter of agility.
Researcher:
Okay, perfect, thank you. I will take note.
Participant:
But I really enjoyed working on the platform, it was very intuitive, I had no difficulty, I did it quickly. I'm not the most patient person, but it was like that, very easy to do.
Researcher:
So, you are a good participant for the study, then.
Participant:
Because I'm not a patient person that keeps trying several times, I try once, if I can't, I already give up, but I did it the first time, it was great, everything worked out.
Research
If you had tried and failed, it would also be good feedback for me, right?
Because it was a sign that I still had more things to improve, to perhaps review the way things are done. And the file that was downloaded is in a different format, which is EPUB, did you already know this format?
Participant:
EPUB, I already knew.
Researcher:
And did you also open in the same application, VoiceDream, or another one?
Participant:
Right. It was saved in my cell phone files, then I opened it in VoiceDream and read it, it was easy.
Researcher:
Ok, great.
So if you have any more suggestions, any more recommendations, something that you think is important to mention, please let me know.
Participant:
No, I don't have any more suggestions, just congratulate you for your work, say that this is very interesting, and it is more inclusion, I am very happy with this new form of inclusion.

Participant 8

Code: P8
Age: 44
Gender: Male
Light perception: Yes
Impairment: Low vision

Researcher:
So in the first questionnaire there was a question for you to assess your visual acuity between 0 and 7, you selected 2, how is your vision diagnosed nowadays?
Participant:
It is classified as low vision.
Researcher:
And in your day to day what do you usually use to help you? It's the cell phone, computer…
Participant:
The computer or the tablet because. I can zoom in or increase the font of the letter. This is more practical for me.
Researcher:
Okay, I understood, so it's in the second phase… from what I noticed, you were able to read one cordel online, right? Did you use the tablet too?
Participant:
I did it on the University computer.
Researcher:
Ok, do you know which browser was used for to access the internet?
Participant:
Chrome.
Researcher:
Can you tell me a little about that experience of reading the cordel online? What was easy what was difficult… good, not good.
Participant:

It was good… you have the possibility of you increase the size, there are some percentages, right, that you will gradually increase and then it makes it easier for you to understand and read. In the second part, I was not able to install the application you said…

Researcher:

In your case you were able to read it online, you zoomed in on the page, right, increasing the size of the text on the page, and then when you downloaded it, you didn't have an application or a proper system to read that type of file, right?

Participant:

That's correct.

Researcher:

And let me ask you one more thing: was it easy to find the work, because in the second step I asked you to download a specific work, was it easy to find that work and download it?

Participant:

Yes, it was. I got the name of the work… I copied it I put it in that search icon… then the specific one appeared there. Then I managed to read it… because right below the download option was the cordel.

Researcher:

Exactly. Okay, that is, so also navigating the e-cordel platform from what I noticed wasn't necessarily difficult, right, it wasn't complicated, right?

Participant:

It was not, It was easy.

Researcher:

Ok, do you use more often screen magnification than the screen reader itself or not?

Participant:

Screen magnifier, which allows me to enlarge the font there…

Researcher:

How do you compare the previous experience of reading a cordel with this online version, for example?

Participant:

I liked it, because for me, the online version, it has more accessibility, you manipulate the font size mainly for those who have low vision, it becomes more, as they say, more adapted to the person... So I felt it is more accessible, I liked it. The only thing I felt

more difficult was in the second part, as I was saying, the issue of installing the program, which I didn't find it… it was the only thing I had difficulty with, but online for me it became more accessible.

Researcher:

Ok, I get it. You said you use a tablet too, is it an Android tablet? I'll later look for an app that reads this type of material, and then I will email you… then you also get to know some more tools that can help you on a daily basis, right?

Participant:

Perfect.

Researcher:

So, I have just one more question, in the first questionnaire you said that you had read a cordel before. How was this reading of a cordel? Was it a physical one? How did this happen?

Participant:

It was at a book fair, there was also the online version there… I liked it, because I represented the culture, I found it very regional and interesting too.

Researcher:

So, was there an online version as well?

Participant:

Yes, it was at school. It was a science fair.

Participant 9

Code: P9
Age: 32
Gender: Male
Light perception: Yes
Impairment: Low vision

Researcher:
In your first questionnaire there was a question that was about your visual acuity, and on a scale of 0 to 7 you scored it as 4, right? What is your visual condition?
Participant:
I marked it as 4, I have monocular vision, in the right eye I have less than 5% vision, with a scar in the central region for my vision, this less than 5% is totally peripheral, I practically have no vision, in the right eye. In the left eye it's normal, without major problems, but I have a degree of myopia with astigmatism.
Researcher:
And that prevents you in any way from consuming this electronic material?
Participant:
No, it doesn't, it doesn't prevent it because I have the other eye, the left eye that works normally, despite this small adjustment, I can easily read both physical books and digital books.
Researcher:
Okay. In your case is it necessary to zoom in or enlarge the font of the text, or in most cases is it not necessary? How does this happen?
Participant:
It depends a lot on where I'm accessing, for example, if I access it on my cell phone and the font is a standard one, I usually need to zoom in… but on the notebook that is already a much bigger screen, I don't have so much need… depending on the volume of reading that I am going to do, I usually zoom in. It is much easier for me, I don’t strain my eyes too much.
Researcher:
And in another question to evaluate the degree of satisfaction on a scale of 0 to 5, in the consumption of electronic materials, you marked the degree of satisfaction as a 3, right?

It's not unsatisfactory, but it's not so satisfying either, what is it that prevents you today, for example, from having a better experience when you're consuming this material?
Participant:
In fact, yes, I'm still a fan of the physical book, I'm very close to the physical, it's not that the experience with the digital unsatisfying, but it's more personal. I am a fan of the physical.
Researcher:
OK. And in your experience, or with people you know as well, is it common to have cordels in Braille? Or narrated cordels? Is this common?
Participant:
I've never seen it.
Researcher:
Now about the experience of reading those two cordels on the platform… if I'm not mistaken, you managed to read the first one, but I don't know if you were able to complete the second or not, I think there was some problem to download it, right?
Participant:
I actually downloaded it, but the file didn't open for me.
Researcher:
And in the first book you read, what was the technology you used?
Participant:
I used the cell phone.
Researcher:
And what is your cell phone, the model?
Participant:
It's the iPhone 13.
Researcher:
So, it was probably Safari as a browser, wasn't it?
Participant:
Right.
Researcher:
And were you able to read the work normally or did you have any problems?
Participant:
No, I read it normally.

Researcher:

Did you have to zoom in, increase the font size or was it normal?

Participant:

It was normal, but I think I couldn't zoom in. But I did.

Researcher:

Sure. I'll check that out. And in the second part, it was to search for a specific cordel and download that file. Was this second step also done on the iPhone?

Participant:

No, I started the process on the iPhone, but then, as the file wouldn't open, I sent the file to myself on WhatsApp and downloaded an app on the tablet, which is Android.

Researcher:

And with this app, did you succeed or not?

Participant:

Yes.

Researcher:

OK. And do you remember the name of this app by any chance?

Participant:

The name is EPUBReader.

Researcher:

How do you compare the experience of having read a physical cordel and now having read a digital cordel, both in the web version and EPUB?

Participant:

I found this possibility of reading a cordel in digital format much better… because the physical ones, they were written with a typing machine. Generally, the quality was not very good, also because it was very old, sometimes there were some words that the oldest form of writing in Portuguese was one way, today it is another, and the quality made it very difficult to understand. At least, sometimes I couldn't understand a word, some words, sometimes it was blurred and sometimes the paper was also very fragile, sometimes it damaged easily, and this was difficult for me, and in the situation of having monocular vision and not being able to zoom in in some situations to facilitate reading, I found this possibility of digital much better.

Researcher:

What suggestions you would give me to include or improve the platform now?

Participant:

…I can zoom in there, I told you I couldn't, but I can…
I find the platform very smooth, very easy to access and handle as well. I don't know if this is a setting on the iPhone or if it's from the platform itself, I can switch between light and dark mode with ease. For me, as I have astigmatism, viewing the files in dark mode for me is much more comfortable... I think it would be more publicity.
Researcher:
Okay, okay, got it. Did you already know this EPUB format or was it the first time you had contact with it?
Participant:
It was the first time.