Enhancing Scientific Communication: Prioritizing User Experience in Audiovisual Interfaces

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Abstract: Audiovisual content has emerged as a powerful tool for scientific communication, enabling a broader reach, clearer explanations of complex topics, and greater recognition for researchers. To maximize its impact and fully unleash its potential, accessible and user-friendly interfaces are needed on platforms and mobile apps. This work prioritizes the identification of essential usability requirements for interfaces featuring scientific audiovisual content, aiming to streamline development efforts. Drawing from established literature and an analysis of existing web platforms and mobile apps, we have identified 25 key usability metrics to guide the creation of interfaces that prioritize user experience. Empirical evaluations of these platforms and apps have revealed significant deficiencies in meeting usability criteria such as effectiveness, efficiency, and user satisfaction.

1 INTRODUCTION

Science communication is the diffusion of scientific research and knowledge in a simple and understandable approach to the general public. This not only allows for the democratization of scientific knowledge, enhancing education, but also promotes debates on topics that directly impact people's lives (Lordêlo and de Magalhães Porto, 2012). However, the traditional methods of sharing scientific discoveries, primarily through written publications, can be costly for both authors and readers. Additionally, these methods predominantly reach individuals within the academic sphere, thereby limiting the diversity and size of the audience.

During the last years, there has been significant growth in the consumption of videos and podcasts. This trend is so pronounced that newer generations exhibit different views and behaviors regarding the consumption of content in these formats (Lagger et al., 2017). With its continuous rise, the audiovisual format presents a new channel for scientific communication (Santos, 2022). This format enables the reach to diverse audiences, facilitating the dissemination of complex concepts and fostering new types of interaction.

Despite numerous initiatives aiming to disseminate scientific knowledge, the study of applications with audiovisual content is limited primarily to the realm of online learning (Kim and Kim, 2021). Therefore, dedicated platforms featuring video articles, research results, and application offer valuable opportunities for learning and for stimulating new publications focused on the audiovisual format.

Recognizing the transformative potential of such applications for democratizing scientific knowledge, this study delves into the development of user-friendly and accessible solutions for disseminating scientific videos. As the quality of an interface largely depends on the product's usability, there is considerable interest in studying the interface of these platforms and applications. This is particularly true for the factors that influence user experience and the unique conditions for audiovisual media, thought for simplifying and enhancing its development (ISO/IEC 25010, 2011).

This work prioritizes the identification of essential usability requirements for interfaces that handle scientific audiovisual content. Our aim is to guide development efforts and enhance the effectiveness of this format as an alternative for scientific communication. As a significant contribution to usability studies for audiovisual interfaces, we introduce 25 usability metrics. These are suggested specifically for web

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platforms and applications that deal with audiovisual scientific content. The metrics are organized based on three key usability criteria: effectiveness, efficiency, and user satisfaction. Additionally, we propose a priority scale to assist in evaluation and to inform the development process of these interfaces, keeping in mind the goal to effectively communicate science and reach a wider audience.

2 BACKGROUND

The diversity of web platform users, each with specific skills and restrictions, must be considered during its development to guarantee broad and unrestricted access to the resources and information made available. Therefore, usability represents an essential quality characteristic to facilitate access and keep users engaged on a specific platform. In a complementary way, the format of the content available on a platform must also be properly designed, considering an alternative capable of disseminating knowledge in an agile and efficient way, such as videos.

In this context, section 2.1 highlights the importance of usability, focusing on audiovisual content. Section 2.2 highlights the shortcomings involving the interface of current platforms that publish videos about scientific research.

2.1 Usability

The user interface contributes significantly to the success of software; therefore, for software to be widely used and accepted, it is necessary to ensure that the interaction between the user and the software is satisfactory. In this sense, usability serves as an indication for assessing how well a user interface meets the user's needs.

Usability is one of the eight product quality attributes according to ISO/IEC 25010:2011, a reference model for assessing software quality (ISO/IEC 25010, 2011). It is defined as the extent to which a system can be used by specific users in a given environment effectively, efficiently, and satisfactorily (ISO 9241-11, 2018).

Effectiveness is the user's capacity to achieve its objectives when carrying out the interaction and the level of quality attained. Efficiency is the effort needed to accomplish a task, including any deviations or mistakes committed. Satisfaction refers to the user's acceptance and comfort during the interaction (ISO 9241-11, 2018). Therefore, effectiveness, efficiency, and user satisfaction represent criteria used to assess usability.

While usability focuses on the quality of the user experience, accessibility aims to eliminate barriers so everyone can enjoy the digital world, regardless of their individual needs (Consortium et al., 2018).

The usability of a software system is influenced by several factors, such as functionality, aesthetics, and reliability. Therefore, given the subjective and qualitative nature of this metric, ensuring a good experience with the product requires testing and user research to evaluate the ease of use and acceptability of a system to guarantee a positive user experience. The most used practices are questionnaires, usability tests, and heuristic evaluation (Nugroho et al., 2022).

Heuristic evaluation is one of the most popular techniques for assessing usability, consisting of a small team of examiners who will thoroughly investigate the interface and determine whether the system complies with usability heuristics, which are simple strategies that guide the design of interfaces (Nielsen, 1995).

A popular and well-known set of heuristics for user interface design, called Nielsen's Heuristics, provided the foundation for other specialized heuristics (Nielsen, 1994b). For instance, Eliseo et al. (2017) uses Nielsen's ten heuristics to evaluate the usability of interfaces of five well-known websites with audiovisual content.

Regarding usability for video content, Shade (2014) presents usability principles for videos based on Nielsen heuristics. However, these principles are very simplified and subjective. Therefore, there's a need for more specific guidelines to guide the development of audiovisual interfaces.

2.2 Audiovisual Scientific Interfaces

Videos have become one of the most popular formats for sharing information. Audiovisual scientific interfaces, a type of human-computer interaction, use sound and vision to represent and interact with scientific data, communicate scientific results, and educate the public about science. In recent years, scientific videos have become more accessible to people, with production and sharing becoming more widespread (Rosenthal, 2020). These videos can be found on general video websites, such as YouTube, or specific platforms for scientific videos with an important impact on knowledge transfer and particularly for improvement of science communication and research activities focusing on content, authorship, epistemic quality and impacts on science communication(Boy et al., 2020).

We searched related works of audiovisual scientific interfaces to find, understand, and analyze scientific audiovisual interfaces. As a result, we selected a group of five web platforms and five mobile applications. The selection considered aspects of the service provided, such as the type of scientific videos, open access, popularity, cost for publication, and science areas accepted. As YouTube is not a specific platform for scientific videos it was not considered in the following analysis.

2.2.1 Web Platforms

The ScienceTalks platform (available at https://www.sciencetalks-journal.com/) is a scientific journal in which publications are in video format. It is open source, and all videos are available for free viewing, but the publication has a fee.

The scientific video journal JoVE (available at https://www.jove.com/) publishes scientific research in audiovisual format. The platform is paid, with different plans for researchers and educational institutions, while some videos are open access. Additionally, for publishing a video, there is a publication fee.

Scivpro (available at https://scivpro.com/) is a scientific audiovisual content platform launched in 2018 to present high-quality, professionally edited videos for free. The publishing service is paid for and includes filming and editing of videos.

Latest Thinking (available at https://lt.org) is a platform for scientific communication that seeks out high-quality, publicly accessible videos. The content is open access; however, the videos are not peer-reviewed. The publishing process is paid for by the author or funding institution.

Finally, STEMcognito (available at https://stemcognito.org/), founded in 2021, focuses on sharing scientific videos in the areas of science, technology, engineering, and mathematics - STEM. The videos are checked by experts in the field but do not go through a peer review process, and access to the videos is free. Video publishing is free for authors in the education and nonprofit sectors.

2.2.2 Mobile Applications

The app Wonder Science (available on Apple Store and Play Store) is a streaming service that shares science videos of high artistic quality. The service is paid, with a few free videos.

TED (available on Apple Store and Play Store) is an application that shares videos of TED events and conferences. All content is free and from a diverse set of topics.

The app Scishow (available only on Play Store) came from a YouTube channel, and all videos are free with support for more than 15 languages.

NewScientist (available on Apple Store and Play Store) is a scientific journal application for sharing news in written and video formats. Part of the content is free, but there is selected news for subscribers.

The NASA app (available on Apple Store and Play Store) shares news and information about the organization with images, articles, and videos, all with free access.

3 USABILITY METRICS FOR INTERFACES WITH SCIENTIFIC AUDIOVISUAL CONTENT

This section presents the 25 usability metrics structured to develop and evaluate interfaces with scientific audiovisual content. Furthermore, we adapted three of these metrics, highlighting the necessary modifications according to the specificities of web applications. The usability metrics represent the result of an extensive literature review on usability practices. So, it represents a select and relevant set of metrics to guide the creation of interfaces that prioritize user experience. We structured such metrics based on criteria used to assess usability: effectiveness, efficiency, and user satisfaction.

System Status - M01: The users should know the current interaction status, which page or tab is accessed, and how to exit from an action. Also, it should warn the users of loading pages and if interactions are working (Nielsen, 1994a; Consortium et al., 2018).

Familiar Language - M02: Use familiar language for text, icons, graphs, and other elements. The user should be able to understand the words and text easily, and technical terms and slang should be avoided (Lakoff and Johnson, 2008).

Information Is Logically Presented - M03: Information should be presented logically and naturally; therefore, the users can intuitively navigate the interface (Lakoff and Johnson, 2008).

Compatibility with Devices - M04: The interface should be responsive since users access web content from different devices; the interaction should happen without problems and frustrations (Eliseo et al., 2017).

Support for “undo” and Show How to Leave an Interaction - M05: Users make mistakes, and offering the ”undo” option increases the user’s freedom and control. Additionally, users should be able to exit an interaction easily and without previous knowledge (Nielsen, 1994a)

Links with a Purpose - M06: Links should be recognizable, with clear text and purpose understandable by text or context (Consortium et al., 2018; Nielsen, 1995).

Consistency in Icons and Buttons - M07: Icons and buttons should be consistent throughout the system for easy recognition (Nielsen, 1994a).

Consistency Between Pages - M08: Pages should have a consistent design following the system patterns; this allows intuitive and straightforward navigation (Nielsen, 1994a).

Warning Messages - M09: The system should present visual warning messages in critical interactions, especially when it’s impossible to undo the action (Nielsen, 1995).

Help in Context - M10: Systems should offer help and support according to the functionalities, pages, or content accessed instead of long tutorials. For Frequent Asked Questions (FAQ), there should be divisions by context (Nielsen, 1995).

Search - M11: Search mechanisms should be present, especially for systems with videos. Search options facilitate navigation and save time and effort (Eliseo et al., 2017).

Content and Interface Focus on the Essential - M12: Avoid unnecessary information. The non-essential content can pollute the interface’s design and create a bad user experience (Nielsen, 1994b).

White Space - M13: The interface should be designed with white space in mind; these spaces allow a clear and better visual experience and facilitate finding the necessary content (Norman, 2007).

Use of Design Principles - M14: Design principles such as scale, hierarchy, balance, and contrast can guide the user’s attention more intentionally, along with providing a pleasant visual experience (Poulin, 2018).

Errors Are Presented in Natural Language and Following Standards - M15: Error messages should be simple and direct, explaining the problem and how to solve or avoid it. Standard error message symbols, such as red text and attention signs, should be followed (Nielsen, 1994b).

Subtitle and/or Transcription - M16: Offering subtitles and transcriptions for videos allows users with different needs and situations to access the content (Eliseo et al., 2017; Consortium et al., 2018).

Response Time - M17: The response time of content should not be prolonged, which might lead users to get disinterested (Eliseo et al., 2017).

Information About the Videos - M18: Users should get access to information about the videos, such as summary, author, keywords, among others. Offering this information helps the users decide whether to engage with videos (Eliseo et al., 2017).

Video Control - M19: The user should have control over the video, when it starts, stops, adjusts volume, among others (Eliseo et al., 2017).

What and When to Watch - M20: The user should be able to choose what, when, and how to watch the videos (Eliseo et al., 2017).

Standard Video Control Icons - M21: Use standard icons for video control so the users will be already familiar with the interaction (Eliseo et al., 2017).

Appropriate Post-Video Action - M22: After watching a video, the post-video action should be adequate; avoid automatically starting new videos or recommending nonrelated videos (Eliseo et al., 2017).

Text Alternative - M23: Nontextual content, such as images, videos, graphics, and icons, should have an alternative text for screen readers and problems fully loading content (Eliseo et al., 2017; Consortium et al., 2018; Chiuchi et al., 2011).

Appropriate Color Usage - M24: Consider the accessibility of the content, especially with the use of colors, which should not be the only form to show an element (Consortium et al., 2018).

Ability to Resize - M25: Content should be resized up to 200% without loss of functionality (Consortium et al., 2018).

Additionally, three metrics were adapted for mobile applications promoting an appropriate approach to the specific characteristics of these devices. These metrics are numbered with a double "M" to differentiate them from the corresponding metrics.

Video Transmission Performance - MM04: For mobile applications, there is a higher concern over transmission performance since the internet connection is not stable. If the transmission is not satisfactory, the video will demand time to begin and load repeatedly, which affects the user experience (Hussain et al., 2016).

Proper Sizes - MM06: Mobile devices have smaller screens, and usually, the interaction is touch-based, which needs adaptation for the size of buttons, text, and images (Budiu, 2015).

Adjust Video Quality - MM25: Since mobile devices have a limitation regarding connectivity, it is necessary to allow users to adapt the video quality according to their preferences and capacity (Hussain et al., 2016).

In addition to structuring the metrics, the three usability criteria (effectiveness, efficiency, and user satisfaction) also supported the definition of a priority system. Each metric was classified regarding usability criteria affected by not attending to it. We establish three priority levels: high, medium, and low. Tables 1 to 3 show the metrics grouped by priorities according to criteria. This priority system allows the use of these metrics as requirements for software development accordingly.

Table 1 includes high-priority metrics whose failure to meet compromises effectiveness and efficiency or both effectiveness and user satisfaction. Table 2 includes medium-priority metrics whose failure to meet compromises effectiveness or both efficiency and user satisfaction. Finally, Table 3 includes low-priority metrics whose failure to meet only compromises efficiency or user satisfaction.

4 EVALUATION AND RESULTS

In this study, the five web platforms (ScienceTalks, JoVE, Scivpro, Latest Thinking e STEMcognito) and five mobile applications (WonderScience, TED, SciShow, NewScientist, NASA) were evaluated according to the 25 metrics presented previously. The degree of adequacy of each interface was assessed through the proposed prioritization of metrics to help obtain a more structured view of the contribution of platforms and applications to scientific communication through video articles.

Similar to Eliseo at al. (2017), the evaluation procedure was based on a heuristic evaluation, using the metrics defined as a guide. A pre-defined list of tasks was followed in each interface evaluation while observing the overall experience with the interaction to determine whether the metrics had been completely (green), partially (yellow), or not achieved (red), as shown in Table 4. Note that when is not possible to analyze a metric, it is indicated with "NA", what means "Not Applicable".

4.1 Web Platforms

Table 4 shows for the high-priority metrics, despite the significance of search engines in systems with video libraries, that the Scivpro and STEMcognito platforms performed poorly in M11 (Search). M16 (Subtitle and/or transcription) and M23 (Text alternative), two medium-priority metrics, are particularly noteworthy as they encountered issues on four out of five platforms. Concerning the low-priority metrics, metric M10 (Help in Context) stands out because none of the platforms completely cover it. While Scivpro and STEMcognito did not fully meet M14 (Use of design principles), the ScienceTalks and STEMcognito platforms did not fully meet metric M08 (Consistency between pages). It suggests that the design of these interfaces needs attention.

Regardless of the priority category, all platforms fully satisfied the metrics directly related to the videos (M17, M18, M19, M20, M21, M22), according to the analysis done using the platforms, which illustrates the significance of guaranteeing high-quality interaction with the video content offered by these platforms.

After the empirical evaluation, we analyzed the resulting data, considering the priorities assigned to each metric. Thus, for each priority, weights were defined on a scale of 1 to 6, as follows: low priority – weight 1 if the metric was partially achieved (yellow) and weight 2 if it was not (red); medium priority – weight 3 if the metric was partially achieved (yellow) and weight 4 if it was not (red); high priority – weight 5 if the metric was partially achieved (yellow) and weight 6 if it was not (red). to

Table 5 shows the number of metrics for each web platform evaluated that received each of the established weights. Furthermore, it shows the total score, which is calculated by multiplying the number of metrics inside the cell by the weight associated with priority. The lower the total score obtained, the more appropriate the interface is for usability issues. Therefore, the positive highlight is for the JoVE platform with the most appropriate interface, and the negative highlight is for the Scivpro platform, which presented the most usability problems in the evaluation carried out. Although Latest Thinking and STEMcognito

Table 1: High priority metrics.

Criteria	Metrics
Effectiveness and Efficiency	System status - M01 Support for “undo” and show how to leave an interaction - M05 Warning messages - M09 Search - M11
Effectiveness and User Satisfaction	Information is logically presented - M03

Table 2: Medium priority metrics.

Criteria	Metrics
Effectiveness	Compatibility with devices - M04
Efficiency and User Satisfaction	Video transmission performance - MM04 Errors are presented in natural language and following standards - M15 Subtitle and/or transcription - M16 Response time - M17 Video control - M19 What and when to watch - M20 Text alternative - M23

Table 3: Low priority metrics.

Criteria	Metrics
Efficiency	Links with a purpose - M06 Help in Context - M10 Adjust video quality - MM25
User Satisfaction	Familiar language Consistency in icons and buttons Consistency between pages - M08 Content and interface focus on the essential - M12 White space - M13 Use of design principles - M14 Information about the videos - M18 Standard video control icons - M21 Appropriate post video action - M22 Appropriate color usage - M24 Ability to resize - M25 Proper sizes - MM06

have obtained the same total score, the last one has a small advantage. This is because a higher frequency (6) was registered for low priority metrics. Note that a metric is disregarded when indicated NA (Not Applicable).

4.2 Mobile Applications

In contrast to web platforms, mobile applications displayed a higher quantity of metrics unfulfilled. Table 6 shows, once more, the metrics less fulfilled were M10 (Text alternative), M16 (Subtitle and/or transcription), and MM25 (Adjust video quality), with at least three applications having usability problems with this metrics.

Despite the importance of video searching, the SciShow and NewScientist applications did not meet the M11 (Search) metric. Moreover, the SciShow application is notable for achieving completely only one of the five high-priority metrics, impacting the inter-

Table 4: Priority and metrics evaluation for each web platforms.

Priority	Metric	ScienceTalks	JoVE	Scivpro	Latest Thinking	STEMcognito
High	M01	🟢	🟢	🟢	🟡	🟢
	M03	🟢	🟢	🟢	🟢	🟢
	M05	🟢	🟢	NA	🟢	🟢
	M09	🟢	🟢	🟢	NA	🟢
	M11	🟢	🟢	🔴	🟢	🟡
Medium	M04	🟢	🟢	🟢	🟢	🟢
	M15	🟢	🟢	🟢	🟢	🟡
	M16	🔴	🟡	🟡	🔴	🟢
	M17	🟢	🟢	🟢	🟢	🟢
	M19	🟢	🟢	🟢	🟢	🟢
	M20	🟢	🟢	🟢	🟢	🟢
	M23	🟡	🔴	🔴	🟡	🟢
Low	M02	🟢	🟢	🟢	🟢	🟢
	M06	🟢	🟢	🟢	🟢	🟢
	M07	🟢	🟢	🟢	🟢	🟢
	M08	🟡	🟢	🟢	🟢	🟡
	M10	🟡	🟡	🔴	🔴	🟡
	M12	🟢	🟢	🟢	🟢	🟡
	M13	🟢	🟢	🟢	🟢	🟡
	M14	🟢	🟢	🟡	🟢	🟡
	M18	🟢	🟢	🟢	🟢	🟢
	M21	🟢	🟢	🟢	🟢	🟢
	M22	🟢	🟢	🟢	🟢	🟢
	M24	🟢	🟢	🟢	🟢	🟢
	M25	🟢	🟢	🟢	🟢	🟡

Table 5: Results of total score for web platforms.

Priority (Weight)		ScienceTalks	JoVE	Scivpro	Latest Thinking	STEMcognito
High	Unfulfilled (6)	0	0	1	0	0
	Partially (5)	0	0	0	1	1
Medium	Unfulfilled (4)	1	1	1	1	0
	Partially (3)	1	1	1	1	1
Low	Unfulfilled (2)	0	0	1	1	0
	Partially (1)	2	1	1	0	6
Total score		**9**	**7**	**16**	**14**	**14**

face's usability.

MM25 (Adjust video quality) is not completely achieved by the TED, SciShow, and NASA applications, and M10 (Help in Context) is not completely achieved by any application. On the other hand, metrics M17 (Response time), M21 (Standard video control icons), and M24 (Appropriate color usage) stand out for achieving complete compliance across all applications.

Finally, Table 7 shows the total score accumulated for each mobile application. Thus, SciShow obtained the worst result among the mobile applications evaluated. In contrast, TED provides an interface well-suited for the user experience.

5 CONCLUSIONS

The increasing adoption of audiovisual formats for science communication has been a notable trend in recent years, opening new avenues for sharing scientific knowledge. The development of user-friendly web platforms and mobile applications has become crucial in disseminating this content, with a strong emphasis on prioritizing usability, which significantly influences the quality and success of these interfaces.

Aligned with the transformative potential of the applications for democratizing scientific knowledge, our study fills a substantial research gap related to usability assessments for interfaces featuring audiovi-

Table 6: Priority and metrics evaluation for each mobile applications.

Priority	Metric	Wonder Science	TED	SciShow	NewScientist	NASA
High	M01	🟢	🟢	🟡	🟢	🟢
	M03	🟢	🟢	🟡	🟢	🟢
	M05	🟢	🟢	🔴	🟢	🟢
	M09	NA	🟢	🟢	NA	🟢
	M11	🟢	🟢	🔴	🔴	🟢
Medium	MM04	🟢	🟢	🟢	🟢	🟡
	M15	🟢	🟢	🟢	🟢	NA
	M16	🟢	🟢	🔴	🟡	🔴
	M17	🟢	🟢	🟢	🟢	🟢
	M19	🟡	🟢	🔴	🟢	🟡
	M20	🟢	🟢	🟢	🟢	🟡
	M23	🔴	🟢	🟡	🟢	🟡
Low	M02	🟢	🟢	🟡	🟢	🟢
	MM06	🟢	🟢	🔴	🟢	🟢
	M07	🟢	🟢	🟡	🟢	🟢
	M08	🟢	🟢	🟢	🟢	🟡
	M10	🔴	🔴	🟡	🟡	🟡
	M12	🟢	🟢	🔴	🟢	🟢
	M13	🟢	🟢	🟡	🟢	🟢
	M14	🟢	🟢	🟡	🟢	🟢
	M18	🟢	🟢	🔴	🟢	🔴
	M21	🟢	🟢	🟢	🟢	🟢
	M22	🟢	🟡	🟢	🟢	🟢
	M24	🟢	🟢	🟢	🟢	🟢
	MM25	🟢	🔴	🔴	🟢	🔴

Table 7: Result score for each mobile applications.

Priority (Weight)		Wonder Science	TED	SciShow	NewScientist	NASA
High	Unfulfilled (6)	0	0	2	1	0
	Partially (5)	0	0	2	0	0
Medium	Unfulfilled (4)	1	0	2	0	1
	Partially (3)	1	0	1	1	4
Low	Unfulfilled (2)	1	2	4	0	2
	Partially (1)	0	1	5	1	2
Total score		**9**	**5**	**46**	**10**	**22**

sual content, particularly regarding metrics, criteria, and a priority scale within the domain of informative videos. Thus, our effort to identify and establish usability metrics tailored for web platforms and mobile applications hosting scientific audiovisual content represents a significant contribution to this field. By centering our approach on three pivotal usability criteria—effectiveness, efficiency, and user satisfaction—this paper offers a comprehensive framework for evaluating usability.

Finally, the empirical evaluation performed with five web platforms and five mobile applications analyzing the 25 identified usability metrics provided valuable insights. This analysis not only deepened our understanding of these metrics but also embraced concepts to ensure that the dissemination of scientific knowledge through audiovisual media become effective, efficient, and user-satisfactory, fostering a more inclusive, engaging, and accessible environment for all knowledge users.

REFERENCES

Boy, B., Bucher, H. J., and Christ, K. (2020). Audiovisual science communication on tv and youtube. how recipients understand and evaluate science videos. *Frontiers in Communication*, 5:608620.

Budiu, R. (2015). Mobile user experience: limitations and strengths. *Nielsen Norman Group*, 19:5.

Chiuchi, C., Souza, R., Santos, A., and Valêncio, C. (2011).

Efficiency and portability: Guidelines to develop websites. pages 37–41.

Consortium, W. W. W. et al. (2018). Web content accessibility guidelines (wcag) 2.1.

Eliseo, M. A., Casac, B. S., and Gentil, G. R. (2017). A comparative study of video content user interfaces based on heuristic evaluation. In *2017 12th Iberian Conference on Information Systems and Technologies (CISTI)*, pages 1–6. IEEE.

Hussain, A., Mkpojiogu, E. O., and Mohmad Kamal, F. (2016). Mobile video streaming applications: A systematic review of test metrics in usability evaluation. *Journal of Telecommunication, Electronic and Computer Engineering*, 8(10):35–39.

ISO 9241-11 (2018). ISO 9241-11: 2018, ergonomics of human-system interaction — part 11: Usability: Definitions and concepts.

ISO/IEC 25010 (2011). ISO/IEC 25010:2011, systems and software engineering — systems and software quality requirements and evaluation (square) — system and software quality models.

Kim, J. and Kim, J. (2021). Guideline-based evaluation and design opportunities for mobile video-based learning. In *Extended Abstracts of the 2021 CHI Conference on Human Factors in Computing Systems*, pages 1–6.

Lagger, C., Lux, M., and Marques, O. (2017). What makes people watch online videos: An exploratory study. *Computers in Entertainment (CIE)*, 15(2):1–31.

Lakoff, G. and Johnson, M. (2008). *Metaphors we live by*. University of Chicago press.

Lordêlo, F. S. and de Magalhães Porto, C. (2012). Divulgação científica e cultura científica: conceito e aplicabilidade. *Revista Ciência em Extensão*, 8(1):18–34.

Nielsen, J. (1994a). Enhancing the explanatory power of usability heuristics. In *Proceedings of the SIGCHI conference on Human Factors in Computing Systems*, pages 152–158.

Nielsen, J. (1994b). Usability inspection methods. In *Conference companion on Human factors in computing systems*, pages 413–414.

Nielsen, J. (1995). How to conduct a heuristic evaluation. *Nielsen Norman Group*, 1(1):8.

Norman, D. (2007). *Emotional design: Why we love (or hate) everyday things*. Basic books.

Nugroho, A., Santosa, P. I., and Hartanto, R. (2022). Usability evaluation methods of mobile applications: A systematic literature review. In *2022 International Symposium on Information Technology and Digital Innovation (ISITDI)*, pages 92–95. IEEE.

Poulin, R. (2018). *The language of graphic design revised and updated: An illustrated handbook for understanding fundamental design principles*. Rockport Publishers.

Rosenthal, S. (2020). Media literacy, scientific literacy, and science videos on the internet. *Frontiers in Communication*, 5:581585.

Santos, A. B. (2022). Publicação de videoartigos como estratégia para impulsionar o consumo de ciência. *Transinformação*, 34:e220011.