VisuoLab: Building a sign language multilingual, multimodal and multifunctional platform

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Abstract

VisuoLab is a multifunctional, multimodal and multilingual platform designed for sign language communities. This platform is based on web accessibility and usability, and is specifically designed in a visual way. All resources are organized to be available in sign languages and written languages for different purposes: to provide materials related to and in sign languages, to produce materials (such as papers, video books, teaching materials that include signing production), to teach with signing tools, to interpret and translate activities for training purposes, and to evaluate signing progress. VisuoLab is designed as an open source platform. The current stage of VisuoLab is a beta version available in the development area of Levante Lab for the platform: https://visuolab.levantelab.com.br/

Keywords: Visual design, Sign language documentation, Sign language visualization, Sign language learning, teaching and assessment tools, Sign language translation and interpretation tools

1. Introduction

The VisuoLab platform[1] was born out of the need to have a robust website built and accessible in sign languages for different purposes. The initial focus was on creating sign language materials, sharing sign language publications, teaching in sign language, and interpreting/translating between sign languages and written and spoken languages. VisuoLab includes interfaces designed for signing communities, following the basic idea of Signbank 2.0. It aims to enable signers with diverse needs by using a visually accessible platform equipped with interfaces based on sign language and to develop a portal and a dashboard in which users can make their own changes, updates, and adaptations in the platform at any time.

The VisuoLab platform is being developed to be an open resource different from some of the previous platforms that we used as a starting point in specific modules.

For the sign language repository, we started from the Portal of Libras (https://portal-libras.org/) which was also established based on previous portal improvements considering feedback from its users. The repository is designed to make materials available in sign language, with deaf people as the main target group. It is a place where we bring together publications in sign language. It is an innovative portal in terms of accessibility of materials in sign language and in

having a dashboard that its users can access and manage based on sign language.

Levante Lab also had previous platforms developed for the Brazil Ministry of Education that were implemented to make a more autonomous administration of the tools to be accessible to the users. One drawback of the previous platform is that it requires developers to work on changes to the system that could be done by the administrators of the platform. Working from these previous developments, we applied the two user spaces of the platform for Signbank first (already available for Libras[2] and soon available for other sign languages), and then we improved and implemented the Visuolab, incorporating recent feedback from these platforms and improving the existing prototype. The two spaces, one for the administration of the platform and the other for the final users with different modules, are developed in ways to make the whole platform independent of the developers.

The production of the multimodal materials module has been developed in the platform based on previous experiences of signed video books produced in Brazil, such as Sign Language Acquisition[3], Libras Grammar[4], and International Sign Language: Sociolinguistic Aspects[5]. In these previous works, we needed to hire a company to implement the video book. In the context of the platform, we are developing tools for the user to create their own video book or other resources.

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[1] Link to the ongoing development of the platform: https://visuolab.levantelab.com.br/en
[2] https://signbank.libras.ufsc.br/en

[3] https://libras.ufsc.br/arquivos/vbooks/aquisicao/
[4] https://libras.ufsc.br/arquivos/vbooks/gramatica/
[5] https://libras.ufsc.br/arquivos/vbooks/internationalsign/

The development of other Visuolab modules of sign language learning, teaching and assessment and of interpreting and translation was inspired by *ProSign* products (Rathmann et al., 2019), YASLA (https://web.yasla.de/), GoReact (https://get.goreact.com/) and Moodle-based teaching and learning resources in the Deaf Studies BA and the Sign Language Interpreting MA at Humboldt-Universität zu Berlin (see e.g. Barbeito Rey-Geißler et al., 2018).

Both Yasla and GoReact are commercially available. However, it has been and always will be a challenge for public Higher Education institutions to ensure funding for these products on the regular basis (e.g. in Brazil).

For these modules, we have developed resources of videos with interactions from users, including comments in videos and written form, as well as the use of chats combined with the video, which can be the source of an activity for the class or for translation and interpretation. Student data is not stored on an external server.

The *ProSign* Portal at the European Centre of Modern Languages (ECML)[6] was designed to make available resources for sign language learning, teaching and assessment). These resources follow the European Reference Framework of Teaching Languages[7].

The resource is a tool for teachers to develop sign assessment activities that give feedback to students on their development in their sign language learning process. Visually accessible ProSign resources integrate sign language education with the Council of Europe's developments in language education within the framework of the Common European Framework of Reference (CEFR). This previous work has also influenced the organization of the materials for sign language teaching purposes on the platform, combined with the previous experience of Moodle-based e-learning resources developed at the Humboldt-Universität zu Berlin in the context of the CEFR (Common European Framework of Reference).

The focus is on promoting autonomous learning and the concept of blended learning. These resources provide students with the opportunity to independently improve their language competencies in DGS by using e-learning-based Moodle tools, regardless of time and place, alongside classroom learning. In the receptive domain, the various e-learning activities include tasks using multiple-choice questions, true/false questions and drag-and-drop questions. In the productive domain, the tasks involve creating a video recording directly in Moodle, followed by a self-assessed test. Furthermore, the integration of

h5p videos in Moodle enables an interactive video learning experience. Moreover, assessments are used for different purposes including self-evaluation and examination of the respective sign language proficiency level, as well as reflecting on one's own sign language competence within the framework of the European Language Portfolio, ELP.

VisuoLab incorporates the expectations of teachers/instructors and researchers working in sign language and interpreting programs regarding the possibilities of creating sign language materials and tools for learning, teaching, assessment and research. These foundations have led to a robust VisuoLab platform, adding the creation and interaction spaces using sign language as the primary language. Some of the types of expectations incorporated are the following: (1) the possibility for the administrator user to add videos in sign language to the platform's menus; (2) the inclusion of markers in sign language videos to indicate the topics of the videos, which makes it easier to know what type of content is explained in a given minute of the video; (3) the recording of videos within the platform to upload research, teaching, assessment and learning content in sign language from pre-defined subcategories, taking into account areas of impact for the deaf communities; (4) the creation of educational materials for the deaf communities within the platform with the video book tool.

The VisuoLab platform then includes a portal and a dashboard. The portal provides a space for the user account that will have specific credentials to access different parts of VisuoLab. It includes (a) general users who can access the materials shared in the portal; (b) teachers who can create a room for each class, organize the class and the assignments for the students, and assess their sign language proficiency; (c) students, who can access the classes, post their assignments, receive feedback, interact with the teacher, and perform self-assessment (including Language Portfolio and Interpreting Portfolio); (d) creators of new resources, who can create a video book, didactic materials, assignments, and other materials for grammars, anthologies, sign language teaching and learning assessments, and interpreting and translation. In the portal, the database is available to everyone. People who have an account can save their materials and access the areas that their profile allows. Permissions are granted by administrators, managers and teachers to students or assistants, and by material creators to co-authors, editors, designers and assistants. The dashboard is designed to build interfaces based on the principle

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[6] https://www.ecml.at/ECML-Programme/Programme2012-2015/ProSign/PRO-Sign-referencelevels/tabid/1844/Default.aspx

[7] https://op.europa.eu/en/publication-detail/-/publication/297a33c8-a1f3-11e9-9d01-01aa75ed71a1/language-en

of autonomy, giving users the power to manage the platform themselves. This dashboard includes a robust set of resources to manage the whole platform in all multifunctional and multimodal interfaces based on sign language.

To accommodate these different purposes, VisuoLab has four main axes: (1) production of sign language content; (2) availability and indexing of sign language content; (3) research, translation and collaborative learning environments. VisuoLab users can produce their own materials in sign language with different tools, creating videobooks, instructional/didactic resources and literary publications, accessing an area for their creation. The VisuoLab platform is being developed using Davidson's (2008) proposal for a technology-mediated collaborative environment. The idea is that participation is based on different sets of theoretical assumptions of knowledge and authority in decentralized systems. According to Wenger et al. (2002), the community of practice uses technological sources to facilitate and amplify the networks of relationships, so that knowledge is learned through creative techniques. The VisuoLab tools are thus easy for users to access, carefully designed to be visual and based on sign language interactions. Following Camargo and Fazani's (2014) proposals, the technical architecture of the VisuoLab platform has been built based on participatory design approaches and its structure was designed with components and interactions that consider the needs of deaf users. Flor (2016) and Fajardo, Parra, and Cañas (2010) highlight the importance of the use of sign language and the use of contextualized visual resources. We also considered Rosenfeld, Morville, and Arango (2015) with respect to information architecture, which includes the design of localized and understandable information environments. The creation of a technologically mediated collaborative environment fits Davidson's (2008) definition of a generation of tools called Humanities 2.0: "Humanities 2.0 differs from the monumental, data-based projects of the first generation not only in its interactivity, but also in its openness to participation, based on a different set of theoretical premises that decenter knowledge and authority" (Davidson, 2008, pp. 711-12).

The technical and pedagogical requirements and the solutions developed for them both required us to work on the development of the proposed technology in partnership with the deaf users. at different stages of the process (from conception, design phase, development and testing). Without this, the specific challenges of the field would not be satisfactorily addressed, given the difficulty of adapting existing development technologies to the specific needs of sign language users.

Technologies bring new forms of learning, an ubiquitous learning. VisuoLab aims to respond to

a pressing need for access to qualified information by educational professionals and the community in general, and to support training processes for deaf and hearing professionals who work with deaf people, from the perspective of disseminating knowledge on this topic. In addition, VisuoLab has dedicated areas for collaboration that allow its users to publish relevant information on the subject, ensuring constant updating and exchange of information and enabling the diversification and articulation of the public service network for the protection and care of the deaf community. In addition, VisuoLab provides tools that promote a training network and/or community of practice, allowing interaction in sign language and writing. The proposal is therefore possible due to the advantages that networks present in "contingents" (Santaella, 2010). According to Santaella (2010), these learning processes occur with the possibility of making VisuoLab a space that allows users to develop this communication skill at any time and place, through different mobile devices. Thus, ubiquity is associated with mobility, which favors pedagogical practices through access to technologies and establishes a new relationship between space and time. Specifically in the context of sign assessment, we follow Geißler and Barbeito Rey-Geißler (2018) and Barbeito Rey-Geißler, Bittner, and Geißler (in. prep.). It took a collaborative approach in which stakeholders and end-users were actively involved throughout the process. The result is a sign language dominated and deaf-friendly platform because sign language users, deaf experts and deaf professionals have been actively involved in the process.

The feedback of users is being collected in a system built for interaction between users and developers along the process. After approving the prototype, the developers work on the implementation, and the users evaluate it using a shared file in which the user can approve or ask for improvements. The final step is to review the changes by the developers for final approval. This system is also associated with videos showing what the users are accessing. Then, they insert their impressions. It is a very efficient tool, and it is systematic throughout the development process. When necessary, we meet with users and developers to clarify the need for improvements. The basic idea has been to make communication between users and developers very efficient because, in previous experience with the development of platforms in Brazil, we learned that this is a key step of the process.

2. Content production with focus on sign languages

The VisuoLab platform has a specific interface for producing sign language materials. This interface arose from the need to publish video-books, teaching and learning materials, signed papers,
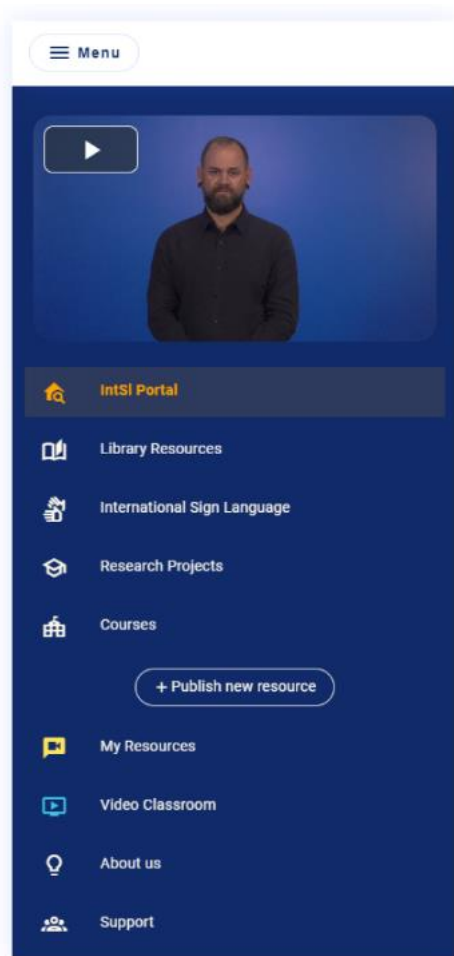
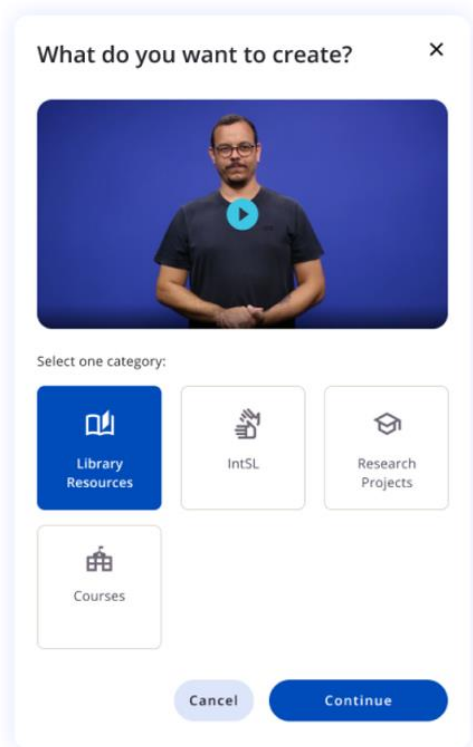Figure 1: Menu of creation of signed materials

and signed videos. The creation of materials allows users to produce work in a multimodal way (sign, written, images, spoken) and to publish their work for the library, in the specific sign language space, as a research project or a course. Each of these categories is organized with tools to support creation with simple interfaces. Figure 1 shows the creation menu and Figure 2 shows the creation options.

The creation interfaces enable users to develop their sign language materials. This space is a collaborative space where authors and researchers can build their publications using sign language resources in addition to the written form. It is also possible to include more than one sign language if translations are available. These materials can be kept as drafts until they are saved. The saved materials can be published on the platform or in other places. They can also be used as resources in the course for teaching and learning within the framework of the collaborative interface.

3. Accessing the portal content

The portal includes a library resources hub which covers all the sign language related materials. It is also a site for grammar, anthologies, teaching, learning and assessment sign language, and when available, it may include Signbank sign language corpora, and glossaries of a particular
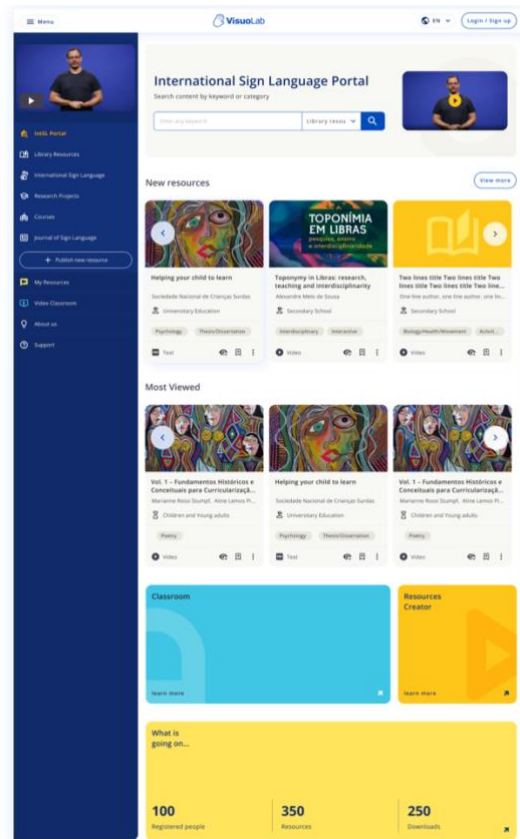

Figure 2: What to create options

Figure 3: General overview of the platform

sign language. Figure 3 shows the view of the International Sign Language Platform as an illustrative example.

Users can search by selecting the parts of the platform, and they can have a general view of the latest materials and the activity of the different axes of the platform (Figure 4).
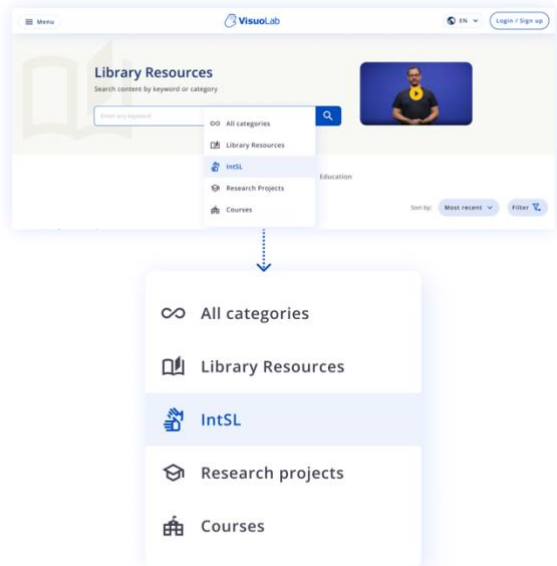

Figure 4: Searching options of the platform

The search can be done by entering a keyword or by category. It is also possible to view the materials by choosing to view all, or by selecting the categories: *Library, IntSL* (or the local sign language of the platform), *Research Projects* and *Courses.* It is possible to sort by most recent, most used and saved.

The login at the top right gives the list of spaces that the specific user has. Administrators and managers have access to the dashboard. The menu shows the general parts of the platform and
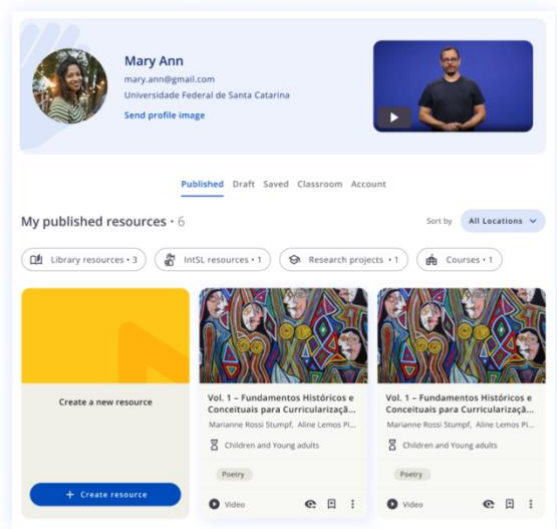

Figure 5: My resources area

the resources of the specific users, where they can directly access all the things they are working on in the platform (for example, classes, interpreting and translation materials, published materials, unpublished or saved drafts, etc.). Figure 5 shows this space.

In the following section, we present the other two spaces that include research, interpreting & translation and collaborative learning environments (courses, creation of resources, and the video classroom).

4. Research, Interpreting & Translation and Collaborative Learning Environments

The VisuoLab platform has multifunctional and multimodal applications that include interfaces for research, collaborative learning, teaching and assessment environments, and translation and interpreting practices. The collaborative learning environments include classrooms with assignments designed for teaching and learning sign language. Teachers can create spaces for classroom activities in sign language, and students can access them and post their answers in sign language. Teachers or students can then add comments, feedback, and suggestions in any sign language activity including formal assessment tasks within the video itself. All these insertions can be accessed directly in the video or in the list of comments related to the activity. The access to these comments is made through an interface that includes markers directly on the video or through the list of comments that may be available in videos or written messages, as shown in figure 6.
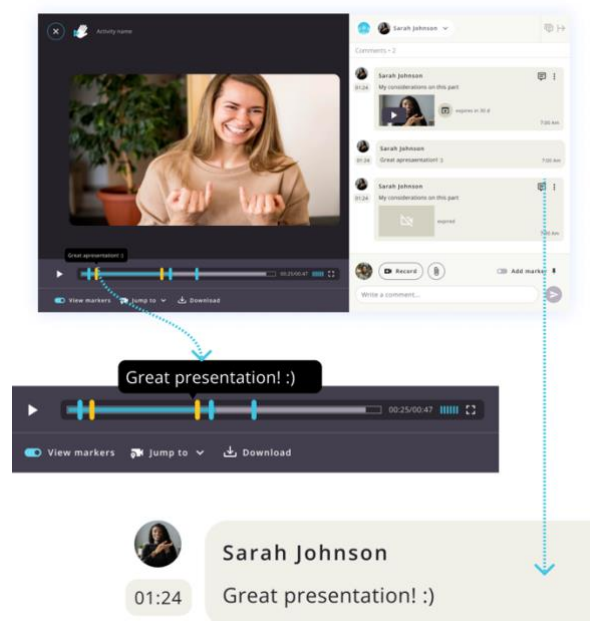

Figure 6: Interface of the learning and translation collaborative work

286

This interactive collaboration makes it possible to improve the videos and produce new versions when necessary and canalso be used for interpreting/translation purposes. The tool includes viewing the video text (signed, written or spoken) in the source language and interpreting/translating this into the target language (sign, spoken or written languages). At the same time, a new video in the target language will be recorded. The interpreted/translated products can also receive comments, suggestions and specific feedback related to different parts of the work done in the video itself. As with the signing activities, there is the option to produce new videos to improve the students' interpreting and translation skills.

In addition, teachers can access the assessment area, including tools of reception, production, and interaction/mediation. Students can use specific tools for self-assessment of their language proficiency in reception, production, and interaction/mediation. Figure 7 shows this interface.

The Video Classroom interface includes rooms (classes), activities and resources. Teachers can see their individual classes and have an overview of what is going on in all their class with the total number of rooms, the total number of activities and the total number of comments. In this interface, the teacher creates new rooms and activities and adds resources.

Room creation includes video lessons, activities, and resources. When the room is created, the teacher adds the participants as students. Students access their lessons through the class(es) created by the teacher, where they can access the activities and post their assignments in sign language or in writing, as needed. The teacher can provide feedback directly to the student in the video in sign language or by adding written notes.

In the creation of library resources, the user has a choice of three categories: *Literature*, *Academic publications* and *Instructional materials*. The sign language resources allow the user to create materials for the corpus, sign bank, grammar, sign language teaching and learning as well as sign language glossaries. These materials can be used to create courses designed at different levels of instruction. The last area of creation is *Research Projects*, where researchers can prepare their publications, including signed papers and signed examples of their publications.

5. Final Considerations

The VisuoLab platform is an open-source platform designed in a community of practice It is currently a prototype, at a testing stage. Deaf teachers, experts and professionals have been involved in the development of VisuoLab. The result of this process aims to be a sign-language friendly and deaf-friendly platform that includes visual interfaces based on sign language communication. It is a multimodal platform with multifunctional and multimodal resources that make it a robust and complex system. It is designed for the creation of content-based materials on sign languages, interpreting and translation as well as on research collaborative learning environments and sign language assessment. The collaborative platform is the underlying concept used to synthesize the interfaces available.

VisuoLab aims to be a robust platform with multifunctional modules inspired by different sources, but all in one place. The leaders of the concept of the platform are mainly deaf professionals working in sign language studies (sign linguistics, sign language learning/teaching/assessment, sign language translation and interpretation): Christian Rathmann, Thomas Geißler and Chris Peters from Humboldt-Universität zu Berlin, Peter Romanek from Tallinn University/Humboldt-Universität zu Berlin and Ronice de Quadros from Universidade Federal de Santa Catarina. Other deaf professionals and students are accessing
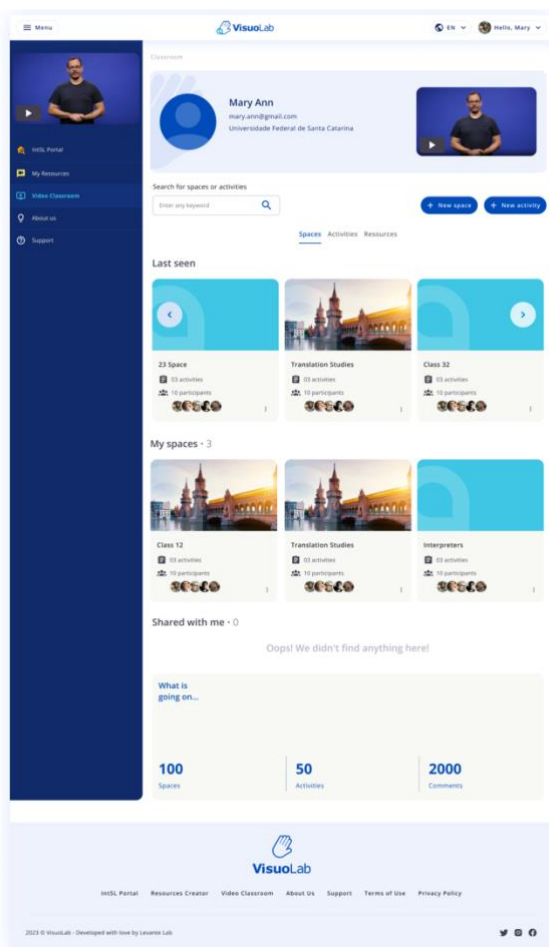

Figure 7: Interface of the classroom

the prototypes for usability purposes during the development process: (1) A quali-quanti questionnaire was sent to deaf and hearing users to identify the real needs of this audience in relation to a learning platform; (2) Benchmarked research was raised for all the important points for the deaf users that other platforms in the area offer to support the development of Visuolab.

The platform is in full development of its beta version at the moment. Some of the modules and features are available and are being tested with deaf users.

In summary, the development methodology implemented follows the pattern of approaching the deaf users from the beginning of the technology design process. Understanding the needs of users, the niche and the public is the first step in this process. The creation step included the definition of the strategies including all the necessary parts to carry out the project. Our focus is on designing the ideal solution, making use of collaborative creation and evaluation tools that help during this process. Then we will apply the Style Guide, Site Map, Prototyping (low, medium, and high fidelity), and Usability Tests. With the tests carried out, the development of the scripts begins. The prototype is mature enough to be implemented, allowing programmers to code and give materiality to the project.

Along these steps, we implemented the procedural development of a platform with a view to overcoming the challenge of combining pedagogical and technical objectives with epistemological respect for the reference area and with a focus on helping the deaf users in their specific learning processes.

Other platforms for this same audience were developed, achieving good product results for the Brazilian education ministries.

Regarding linguistic experiences, the platform is designed with multimodal interfaces. The administrator and the user spaces may include videos in sign language and written text explaining the functions of each tool. This facilitates the understanding of the tools available. Also, videos in sign language can be added in all modules, making the platform a signing environment.

Finally, there are still technical limitations that we are working on. The main limits are related to the limited availability of conversion libraries and the massive storage and distribution of videos on a large scale. Large companies, such as Vimeo, YouTube, and others, have a certain monopoly on these tools and charge for their use. This problem will be overcome through the development of a mass video conversion service with specific features for technology projects aimed at deaf people.

Interested readers can access the developing area of Levante Lab for the platform: https://visuolab.levantelab.com.br/ This area is in development, and it is subject to instability, which is why we have not included it in this short paper that has the goal to introduce the novelty of the VisuoLab.

6. Acknowledgements

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