A Framework to Inform Design of Learning Objects for Teaching Written Portuguese (2nd language) to Deaf Children via Sign Language (1st language)

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Abstract

Bilingualism is the philosophy of choice for deaf education and literacy: deaf children should learn Sign Language for intellectual development, and the written form of the oral language. Unfortunately, educators are still influenced by the clinical view of deafness as a deficiency to be removed, and that view influences their pedagogical praxis that lack proper pedagogical tools. Additionally, there has been a political setback: special schools for the deaf in Brazil are being closed. Mainstream schools are not able to cope with the demands and the deaf are thus further marginalized. This research presents a pedagogical framework that educators have used successfully to prepare classroom-teaching materials. The framework was implemented into a system that guides educators in the design of Learning Objects.

1. Introduction

Bilingual education for the deaf has become a field where the debates are arduous and heated. There is a cacophony of stakeholders focusing alternatively on the deficiency, on the social and cultural diversity or on the differences between deaf and non-deaf as central to the political and educational discussions – each point of view leading to different classroom practices.

For example, the medical view of deafness as a pathological deficiency to be removed has permeated current policies: the goal being to correct abnormalities and avoid differences. The easiest way to achieve such goal is to forbid the deaf to use Sign Language (SL), and to force the deaf to speak like the hearing. These actions prevent proper language acquisition by the deaf [1]. Teachers who follow such philosophy do not use SL as a tool for first or second language acquisition. The lack of language acquisition is detrimental to intellectual development [2].

Deaf students are active in their pursuit of the learning of written Portuguese as a second language (L2), but are discriminated in their schooling process [3]. In spite of the student’s efforts, [4] shows that not much has been accomplished: mainly because there is a lack of official linguistic policy regarding the use of SL and the teaching of written Portuguese as a second language – given that the written form of the oral language is accessible to the deaf. This correct use requires new educational dimensions and methodologies.

Such methodologies must consider that SL as a first language (L1) is not acquired properly at home mostly due to the fact that over 90% of deaf children are born to non-deaf parents who do not use SL. Therefore, in order to use SL to scaffold the learning of a L2 by the deaf, the process must consider the simultaneous learning of SL: Teachers should be bilingual, and teaching of the second language should use the first language. It should also consider literacy experiences outside the school (almost non-existent); and the lexical and grammatical limitations in the Portuguese language by the deaf learner. It is important to remember that learning a L2 requires communication competence, the possibility of action on others, and the organization of knowledge internalization through language.

This article briefly discusses the epistemological bases on which several (inadequate) agenda and power relations about bilingual education for the deaf are established. Such power struggles have led to asymmetric treatment of the majority (oral Portuguese) and minority (SL) languages, where the minorities are diluted in the hegemonic culture (section 2).

Then, the article presents a field study with teachers of both mainstream schools and special schools for the deaf which is analyzed regarding their methodological and pedagogical practices and discourses about deaf and SL acquisition as L1 and the teaching/learning of written Portuguese as L2 (Section 3). The study shows that educators are not bilingual, and do not incorporate SL into their teaching of written Portuguese. Additionally, teachers often limit teaching to lexicon only – at the expense of other linguistic elements such as grammar, articles etc. The results clearly exemplify the need for a cohesive pedagogical framework with which to inform teaching of both written Portuguese and of SL as a basis for this process.
Based on the theoretical and field research findings, the main goal of this article is to propose a Framework (a curriculum planning model) of how to inform design of Learning Objects (LO) for acquisition of written Portuguese via Sign Language (section 4).

The proposed Framework presents linguistic, epilingualistic and metalinguistic activities [5] and is comprised of five steps: Visual contextualization of the text; reading of the text in Sign Language; awareness of meaningful linguistic elements with important functions in the text; individual reading and text re-elaboration.

Finally, as a proof of concept, this article presents an implementation of the proposed framework in a system that guides the educator towards the creation of the desired LO, along with a preliminary case study of its use and results (section 5). In sum, the empirical research presents the lack of proper teaching tools. The main goal of the paper is to present the framework to inform design of pedagogical material. The system is an implementation of the framework; and the learning object is an illustration of a teaching material.

2. Deafness is a great country

Historically, the representations about deafness follow the immanent logic of great master narratives that suggest a discourse that is to be imposed on all other discourses, thus monopolizing meanings, and leaving no room for dissonant voices [3].

The main hegemonic narrative has been that of the audio-centered deafness, a narrative that produces subjects who are deficient, limited and incapable, defined by the experience of absence – of hearing and oral communication. This medicalization of the deafness is presented as unquestionable, and relegates the deaf to a subaltern role within the hegemonic communication in which the deaf had to learn the oral language in order to be accepted – and the degree of her intellectual development is thus conditioned by her experiences via the oral [6].

Although this is but one of the multiple voices that try to objectify the reality [6], the resulting state of things is the lack of language acquisition by the deaf. Fortunately, the creation of Deaf Studies field allows for a new perspective, where the goal is to establish policies that are concerned with the specificity of the difference (race, class, gender, sexual orientation etc.) policies that lead towards freedom [7].

This opposing voices are not coherent and uniform at first: some emphasize the cultural, social and linguistic rights of the deaf (FENEIS), others are strongly attached to the teaching of SL; others promote deaf identity based on linguistic criteria [8]; some use both languages (in a clear linguistic confrontation between the two languages) in a manner that prefers content over linguistic form [9] – and all of these practices lead to a new pattern of exclusion due to the fragmentation of a group that is already a minority; and prevent language acquisition. Section 3 shows results of a field research that demonstrate all these different voices and their (negative) impacts: teachers do not know/use SL, and the teaching of Portuguese is limited.

Language is action on others; it is power and transformation, saturated with content; it is an instance of experience construction through a process of reflection and meaning creation about reality: language is more than its linguistic symbols and it includes ideological and concrete forces of real life they convey in intertwined socio-political and cultural processes [10]. Therefore, social, political and pedagogical aspects are important and should be considered.

According to [11], acquisition is unconscious, and leads to functional rules of the language without the need to know strict rules: given comprehensible input from social environment that is rich enough for abstractions, and an affective involvement with the language, the learners will acquire the language naturally. As for learning, there is a need for a formal and systematic process of instruction that involves memorization of vocabulary, grammar studies, translations etc. along with abilities related to know “about” the language (metalinguistic). These aspects are considered in the framework.

Hearing people acquire a natural language (or first language or mother tongue) with which they can have access to a variety of information; a language used for hypothesis construction, categorizations, generalizations, knowledge acquisition about the world, and to develop judgment of values, among other high level cognitive activities. All of those elements are not available for the deaf children born to hearing parents (90% of the cases) who don’t know SL.

The lack of language acquisition is detrimental to intellectual development [2]. And [12:41] reminds us of the dire consequences faced by the deaf children who do not acquire SL in early infancy: there is a lack of the ability to perform tasks for the development of intelligent action; the deaf does not learn how to plan and how to overcome impulsive action; the deaf does not become independent of the visual, concrete situation and has difficulties to control herself and to socialize.

And the lack of language is detrimental to full citizenship: “starting at the most elementary level of power relations, language constitutes the most powerful barbed-wire to block access to power” [13:22].
The present research follows [3][6] among others, by choosing Literacy of the deaf who identifies with SL and the visual culture, in a bilingual citizenship – as opposed to alphabetization. Alphabetization presupposes access to the sound to make basic associations between phonemes and graphemes – oral-dependent function that is not viable for the deaf [14]. But the written language can be acquired by the deaf if the methodology used takes into account visual strategies based on SL, in a similar (methodological) manner to those used to teach second language for the hearing [15].

Thus, just as the oral language serves as a medium to the learning of the writing system, that later gains autonomy as a symbolic system [2], SL plays a similar role in the teaching and learning of the written language for the deaf.

Literacy is the resulting process of social practices of the use of the written form of the oral language in specific contexts, for specific goals. “Therefore, Literacy as effective appropriation is pleasurable, is leisure, is access to information, is communication, and is a way to exercise citizenship in different social practices.” [3:131].

Although the written language is organized from the oral language, it has some specificities (the oral language is shorter, less complex by using the presence of the interlocutor; in the written language, the absence of the interlocutor requires additional constructions). Such specificities allow for a relative autonomy of the two systems [16].

The deaf does not have access to the oral language but can become a “non-alphabetized reader” who dominates the written form of another language without knowing the sounds of its writing. This requires that the learning is not imitative and mere mechanical memorization, but rather that the learning takes place in meaningful practices that allow the apprehension of the language: deaf children will establish meaning from symbolic relations captured by visual significant (namely, SL) [6].

Additionally, there is a need for linguistic, epilinguistic and metalinguistic actions on the language [5][17]. Linguistic actions use language resources for text constructions in effective usage of the language in meaningful social practices. Epilinguistic actions are those that require some sort of reflection about the elements of the language and its use in the communicative interaction process. Metalinguistic activities involve conscious analyses of the elements of the language (concepts, classifications, names, rules etc.). These discussions imply the need of different methodologies from the traditional ones if we expect the students not to be limited by a formal process of instruction usually distant from its discursive dimension. The proposed Framework addresses such issues (vide section 4), mainly by emphasizing the need to use SL, and the need to teach the second language in its major linguistic aspects.

It is also important to note that the use of a writing system for SL, such as SignWriting, which is based on a pictoric/ideographic representation system with organization system based on visual-spatial signs, would follow a distinct path, a point that is the focus of the research in [18].

3. Voices of the educators

This research conducted a field study in order to investigate the representations and practices of literacy in the context of bilingual education for the deaf in the State of Paraná, Brazil. 320 questionnaires were distributed to teachers who attended a thematic three-day seminar on deaf issues, organized by the Department of Special Education from the State Education Secretary. 260 questionnaires were returned.

Although only 7% of the respondents have knowledge of SL, and more than 90% of them have SL skills between regular and insufficient, 68% of the respondents stated that the philosophy used in their school is that of bilingual education – a clear contradiction (teachers are not bilingual) with the need of the use of SL as the primary language of education for the deaf [3]. This contradiction comes across in the form in which the teachers represent the “other” deaf and dictates the role of representations and their effects on identity. The following are voices from the teachers who support the need of reproduction by the deaf of the hearing identity with its essence in speaking and writing:

“The deaf who has speaking conditions should work on it because they are going to live with hearing people and their alphabetization will be easier.”

“It is possible and necessary to show the deaf the importance of the oral and written language as a means to socialize with the hearing.”

“Speech must be acquired by the deaf as a second language given that they will relate to hearing people”.

These fragmented discourses reproduce the hegemonic discourse found throughout society and ingrained in the praxis: a clear indication that the policies of deaf identity were not in fact incorporated in their representations. The following are extracts of how the respondents address the deaf students:

“We can affirm that the deaf student will never achieve the interpretation and production of writing in an integral manner.”
“For the impaired, the grammar will always be difficult to be assimilated, the writing also.”
“They (the deaf) do not learn because they don’t have a solid base of SL.”
“In spite of her limitations, the deaf can achieve some degree of sufficiency in their production.”

Almost 60% of the respondents declared the use of both languages simultaneously or some form of signed Portuguese during classes. Such practices value content over linguistic form, deforms enunciation in the form of omissions, inventions etc. Additionally, its use of visual resources (mimic, dramatization, gestures) other than SL reduces SL to a secondary role.

The lack of SL knowledge and the lack of a methodology for teaching Portuguese to deaf children imply that the teachers (70% of the respondents) use methodological strategies that are basically lexical, with little to no syntactic relations. Additionally, most teachers do not consider all dimensions of the language (namely, grammar):
“Grammar is not a priority”.
“It is necessary that the Portuguese language be differentiated for the deaf.”
“Grammatical relations should not be imposed on the deaf. The importance should be only on the social function of the written language”.

As can be seen, there is a pseudo bilingualism in which SL is valued only as a means to obtain access to the “real” language. The triumphant discourse of bilingualism has covered the underlying chaos of the experience of the Deaf for whom the development through their natural language is still a distant reality.

The proposed framework addresses these practices by providing teachers with a pedagogical tool with which to create pedagogical materials that take into consideration several aspects required for effective teaching of Portuguese as a second language based on SL as a first language. Otherwise, the deaf will not have access to the learning process.

4. The proposed Framework

In order to provide pedagogical tools to inform design of pedagogical materials for the teaching of the written form of the oral language, the proposed framework aims at promoting intertextuality through social texts – which allows for enhancements of the lexicon and the textual knowledge (argumentation, cohesion, coherence, logical sequence) beyond information acquisition.

Additionally, there are some basic assumptions upon which educators must reflect and embrace: the twofold challenge of using SL to scaffold the teaching/learning of a L2 given the fact that most deaf are not proficient in SL; the L2 is to be taught only in its written form; teaching strategies must go beyond the mere memorization of the lexicon; the need to incorporate activities for all dimensions, including the metalinguistic (grammar) and mostly, the lack of prior literacy practices upon which to build new learning experiences. Texts here include different media, such as an image, a cartoon, a label from a product etc.

Thus, all activities should be preceded by a planning that involves in its organization the following aspects: Visual contextualization of the text; reading of the text in SL; awareness of meaningful linguistic elements with important functions in the text; individual reading and text re-elaboration. Figure 1 shows the 5 steps of the framework:

4.1. Visual contextualization of the text

The text should be contextualized in visual references that allow the deaf to have an initial understanding of the theme so that this knowledge is used in the actual process of reading. This contextualization should be done by the teacher using SL. The text is viewed as a set of verbal and non-verbal language. Reading the images and its relation to an actual student experience will gain the student’s attention and interest. The immediate context should be explored. For example, if the text talks about a department store, students could be prompted about their own experience: have they been to one? Who took them there? What was the purpose? And so on.

It is important that the student is able to access possible interpretations of aspects that are obvious to non-deaf readers. There should be no doubt about the object of the text, given that the remaining activities will rely on this comprehension.

4.2. Reading of the text in Libras

Sign Language should be used to explore the text: possible relations, meanings, questioning and reading hypothesis. It is common for the students to relate
some words to signs, usually “ignoring” some lexical items (such as prepositions, articles, declination and auxiliary verbs). Additionally, the first reading is “literal”, with meaning attribution that may not consider the context. Later, students will be able to explore different acceptations of the words and its meaning in the text – a practice that will enrich vocabulary, and help the student to gain fuller access to the text.

Sign language is more than a mere resource: it acts as a motivation for meaning creation, in an environment where the student is not repressed by linguistic barriers. It is not an exercise of translation, a one-to-one matching of word-sign. It is important that the student be allowed to explore all sorts of information that are part of her daily life.

There should also be a systematization of grammatical vocabulary. At this phase, probing question should be made, in order to help students to elicit previous knowledge. Additional questions will function as a guessing game to help students form their own reading hypotheses about the text. Also, students should be presented with clues to allow them to compare between the structures of both languages.

### 4.3. Meaningful linguistic elements

At this stage of the learning process, some words and expressions have been recognized. The focus should then shift to linguistic elements and their role in the type (narration, description, dialog, dissertation, poetry etc.) and style (different levels of formality or informality).

Punctuation marks, verse or prose, use of capital letters, among others, are examples that will give clues about the content, meanings and genre. Especial attention should be given to elements that are part of the intuition of the native speaker, but that are not accessible to the deaf children. In a dialogue situation, for example, such elements would be the use of various signs to express aspects of the oral language.

It is also the occasion to systematize the grammatical aspects of the text such as verb and its forms, comparing them with the SL structures.

Thus fur, reading has acted as a “guessing game”, given that activities of reading images, fragments, its relations to experiences have been used. All this previous work will empower the student for the next phase: the actual reading.

### 4.4. Individual reading

The previous phases constitute what we call barriers removal, in which all activities comprised of finding, recognizing and identifying aspects that could constitute barriers for the Deaf. They are methodological activities that mediate the creation of superior psychological functions, namely: abstraction, memory, logical reasoning, language etc.

It is time now to have the student read the text individually. Then, the student should engage in activities to position herself in relation to the text as something other than a mere set of words.

### 4.5. Re-elaboration

As reading and writing are joint processes, the student should be given the opportunity to practice writing, mostly in the form of retelling the text, in another genre, for example, given its context. Another possibility would be to bring other texts about the same subject to have the student draw parallels between the texts.

Context here is not the immediate experience (e.g. see a movie and then report about it): children shy away from such practices. A meaningful activity will be that which will result on a practical knowledge that is applicable in the daily life of the student: fill a form, write an e-mail, understand the rules of a game etc.

Metalinguistic elements are not the focus here: Weaver (1996) tells us that reading and writing in a L2 can promote the acquisition of syntactic structures more effectively than its formal study.

### 4.6. Use of the framework

Educators have successfully used this pedagogical framework to prepare LO for over 10 years now at the State of Paraná, Brazil. From a total of 3911 deaf students 1835 attend special education school in 15 major cities. The remainder of the students is dispersed in mainstream schools.

Unfortunately, there has been a political setback, and these few arenas for linguistic excellence are now being closed or transformed into mainstream schools. The deaf are forced to go to these mainstream schools that are not prepared to care for their special needs – and are thus relegated in their learning rights. Such sad state of affairs prompted the research team to implement a computational tool to aid educators to prepare online LO for the students to use to complement their literacy education. The system’s use of video will also provide the teacher with SL resource: given their lack of proficiency in SL, teachers can use pre-recorded videos in SL – thus enhancing their skills, and promoting a more adequate use of SL in the teaching process.
5. Implementation

The framework presented at the previous section is meant to help teachers to think about and prepare educational materials. This article aims at presenting such framework. It was first tested with non-computational tools within classrooms (e.g. paper, signs, images, labels, games etc.).

In order to further explore the potentialities of the framework, it was implemented in a system that will guide the teacher in designing LO. Educators used the system as per the framework to design LOs as a conceptual proof of the validity of the system. This section illustrates one LO.

Such LOs are in the form of web pages that the students will use by themselves. This use by the student is to occur either in the classroom, with the presence of a teacher, or at home – where the parents could join the student. Additionally, it is important to keep in mind that the LO is to be used without the mediation of an interpreter – as all the explanations in SL are pre-recorded. Such use of pre-recorded video address the lack of proficiency in SL by the teachers.

Figure 2 shows how the framework informs the design of LO that the students will use:

![Figure 2. Using the framework to create LO](image)

All the explanations provided by the LO are in SL through videos that the teacher can bring to the system, or that the teacher can record during the creation of the LO. Within the text, as per the five steps of planning prescribed by the framework, the teacher is be able to mark the text in its elements with links to the videos. Figure 3 show the elements that comprise the LO:

![Figure 3. Elements of the LO](image)

One element would be the *inter-textual* aspect, where the explanation will focus on explaining the text itself. Then, the teacher could go on to address the *para-textual* elements, explaining the non-verbal language that might be present on the text (e.g. figures, images, graphs, colors etc.).

The *textual* elements are then explored in its many aspects, with links to videos for glossary, grammar, expressions, vocabulary, meaning in the context of the text etc.

Finally, the teacher should include elements that go beyond the text itself, such as other texts, videos, and additional information about the main theme of the text, parallels with SL etc.

5.1. LO – Department store

Eight (8) educators who have used the framework in its previous paper-based form worked together and used the implemented system, over a period of a month. They created 2 LO that are now in use by a few students at one of the special schools for the Deaf in the State of Paraná: one of an advertisement pamphlet for a house. And a second one showing cartoon characters in a department store. Only one of these LO – the one representing a department store – is presented here for illustration purposes.

Figure 4 shows a print screen of one of the LO using as the image/text a page from a popular Brazilian comic book depicting some of their famous characters shopping for clothes at a department store. The characters are talking about BLUSAS (Blouses). A video explains that women to protect from windy weather use blouses. This print screen shows the use of the LO in its contextualization phase. Other phases follow the same use of videos in SL; due to space restrictions such phases will not be presented.

This image/text represents a social experience that the student might have experienced. It provides several instances of para-textual (e.g. the pictures of the objects) and textual (such as the dialogues and section names). The black bar alongside the image/text has drawings of the elements (skirt, shoes, socks etc.) that can be found in the picture. The student can click on those items to see a video with a glossary. These elements of the LO will serve as glossary explanation, multiple word accept ions and meaning attribution for the word in the specific context of the text.

The balloon on the left lower corner shows a textual explanation of the section names. These paratextual elements, as per the framework, further explain the text using SL videos for a more complete understanding.
This image/text is very adequate for the deaf, given that is very colorful, rich in verbal and non-verbal images thus allowing for visual contextualization.

Upon first opening the LO, the student is presented with a video that describes the image/text as per the first step of the framework. This description provides the introduction and prompts the student to explore the text. The video is then available to be played when needed (this is one unique feature of the system: all videos can be revisited at the student’s individual pace — a desired feat that usually does not occur in a classroom environment).

For the first reading of the text, there are several opportunities with which to work, such as type of cloth, nature and function of clothing. This mediation phase is intentional, and has the goal to present the text in SL. Many are the propositions that can be explored: what is this place? Have you been to a similar store? What do they sell? What are clothes? Is a shoe a cloth too? What are the clothes for women? And form men? What do you wear on a windy day? What is written on the sections? And so on.

The perception of meaningful linguistic elements in the LO is also provided in SL by videos discussing some classifications: Men’s, women’s, Unisex and Child’s clothes; Clothes, Shoes and Accessories; Summer, Winter clothes etc.

5.2. Evaluation – Educators using the system

The educators responded a questionnaire to assess the validation of the system. It was comprised of 16 statements about the system and its characteristics. These statements focus on content, usability, pedagogical and cultural aspects:

1 – Content
   a) representation of social texts
   b) bilingual education
   c) concrete and effective use of SL
   d) flexibility about the content to be used

2 – Usability
   a) easiness of understanding
   b) easiness of use
   c) adequacy for different texts

3 – Pedagogy
   a) promotes creativity
   b) helps to create effective LO
   c) helps to create LO that represent the real world

4 – Culture
   a) helps to think about daily issues
   b) incorporates linguistic, cultural and social issues of the Deaf
   c) helps to create LO for bilingual literacy
   d) allows for concrete use of both SL and the written form of Portuguese

The response was in form of grades in a Likert-type scale: 1 – totally disagree; 2 – disagree; 3 – neutral; 4 – agree; 5 – totally agree.

The educators agreed that the system that implemented the pedagogical framework allowed for the representation of social texts (4.00) for bilingual education (5.00) with concrete and effective use of SL (5.00) with features that provided flexibility about the content to be used (4.00).

The respondents agreed that the system was ease to understand and to use (4.25) and that it was adequate for different types of text (4.00).

Given that the educators had prior knowledge of the framework, they were unanimous in affirming that the implemented system promotes creativity, helps to create effective LO that represent the real world. The respondents pointed out that the system allowed for an rich and diversified LO by the use of hyperlinks to additional contents available outside the LO – in the web.

The implemented framework was very successful in helping the educators to think about daily issues (4.00) and to incorporate linguistic, cultural and social issues of the Deaf (4.00) to inform the design of LO for bilingual literacy (4.75) with concrete use of SL an written Portuguese.

5.3. Evaluation – Children using the LO

The educators designed two LO: one using a page from a very popular comic book in Brazil; and another
with the label of a chocolate powder used to prepare chocolate-milk. Those images along with actual text present in them are very adequate to the visual experience of the Deaf. Additionally, they are part of the social text with which the children are familiar in their daily lives.

A group of 5 children used each LO for 15 minutes for two days in a week. The students varied from 7 to 12 years of age. All had some knowledge of SL, and studied in a special bilingual school for the Deaf.

The students used the LO by themselves. The authors and the teachers were there only as observers. The children immediately demonstrated their motivation to use the LO which seemed like a game to them. The students freely discussed their experiences with one another. The students asked the teacher who appeared on the video about his participation in the process of creating the “game”. They also asked the authors if the “game” was going to be available for them to “play”.

6. Discussions

Political views of deafness as a deficiency have yielded pedagogical practices that are not adequate for deaf education in general, and of language learning in particular. Bilingual education – the adequate philosophy – is not properly used, mainly because teachers are not bilingual. Additionally, the hegemonic discourse disregards SL as the first language for the deaf for knowledge acquisition and intellectual development. This research provides a framework that addresses such problem by encouraging educators to promote SL and use it as a tool for teaching the written form of the oral language – Portuguese in our case. The implementation of the framework helps the teachers who are not proficient in SL by providing pre-recorded videos.

The pedagogical framework, in all of its phases, requires the interaction of the teacher with the student, in the form of probing questions, guidance and assessment – these interactions should be made in SL. Additionally, in its re-elaboration phase, it requires the students to re-write the text. In this first version of the system, the designed LO are meant to be used on a stand-alone basis (i.e. with no interaction with a teacher). Further research is to be done in order to incorporate the aforementioned possibilities.

A data warehouse is to be constructed to allow educators to re-use texts, videos, LO. And the LO should be made widely available over the Internet to reach Deaf students in their pursuit of bilingual literacy.

Learning is a long-term process that requires some sort of assessment; as of the current version, this evaluation of the progress by the students is not implemented nor was it validated due to time constraints and the fact that the students use the created LO in their homes, which requires some sort of online evaluation and feedback.

This is an ongoing research, and, although the researchers are confident that the implementation of a proven pedagogical framework is going to be successful, given the initial validations from both case studies, a longer, more structured validation is going to be performed.

7. References


