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MathLibras in 3rd-grade elementary school: first impressions on three videos of the project

MathLibras en el aula y las primeras percepciones de alumnos de 3º de primaria sobre tres videos del proyecto

MathLibras en classe de 3ème et les premières perceptions de trois vidéos du projet

MathLibras na sala de aula do 3º ano do ensino fundamental e as primeiras percepções sobre três vídeos do projeto

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Abstract

This article aims to describe and problematize the first presentations of three videos from Phase 1 of the *MathLibras* project in a class of deaf students in the 3rd grade of elementary school, in a bilingual school for the deaf in 2022, in RS, Brazil. Each video presents in Libras a narrative that proposes a mathematical challenge related to the additive field based on composition problems. The methodology is qualitative and involved broadcasting three videos in two sessions in which deaf students, a school coordinator, and the *MathLibras* team were present.

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The data comprised filming the presentations and materials students produced. To analyze the videos, the team selected some scenes considered critical events, based on which the students expressed their understanding of the proposed challenge. As a result, the perception of visual errors when editing the images stands out, which generated students' confusing interpretations. One of the teachers had to explain and write the calculation on the board so the students understood the statement proposed in the video. With the explanations and exemplifications written on the board, the students independently solved the challenge proposed in the third video. The reception evaluation also highlighted that actors must signal Libras more slowly, targeting children.

Keywords: Teaching mathematics to the deaf, Sign language, Video, Video lessons.

Resumen

Este artículo tiene como objetivo describir y problematizar las primeras presentaciones de tres videos de la Fase 1 del proyecto *MathLibras* con un grupo de alumnos sordos del 3º año de la Enseñanza Fundamental, en una escuela bilingüe para sordos en 2022, ubicada en RS. Cada video presenta, en Libras, una narrativa que propone un desafío matemático relacionado con el campo aditivo, a partir de problemas de composición. La metodología cualitativa implicó la presentación de tres videos en dos reuniones, que incluyeron estudiantes sordos, una coordinadora de la escuela y el equipo de *MathLibras*. Los datos fueron producidos a partir de la grabación de las presentaciones y materiales producidos por los estudiantes. Para el análisis de los videos, se seleccionaron algunas escenas, consideradas como eventos críticos (Powell, Francisco y Maher, 2004) por el equipo, en las que los estudiantes expresaron su comprensión del desafío propuesto. Como resultado se destaca la percepción de errores visuales al editar las imágenes, lo que generó una interpretación confusa por parte de los estudiantes. Una de las maestras tuvo que explicar y escribir el cálculo en la pizarra para que los alumnos pudieran entender el enunciado propuesto en el vídeo. Con las explicaciones y ejemplos escritos en la pizarra, los alumnos resolvieron de forma independiente el reto propuesto en el tercer vídeo. La evaluación de la recepción también destacó que los actores necesitan señalar Libras más lentamente, pues el video es direccionado a niños.

Palabras clave: Enseñanza de Matemáticas para sordos, Lengua de signos, Video, Lecciones en video.

Résumé

Cet article vise à décrire et à problématiser les premières présentations de trois vidéos de la phase 1 du projet MathLibras dans une classe d'élèves sourds de troisième année de l´enseignement fondamental, dans une école bilingue pour sourds de 2022, située en Rio Grande do Sul. Chaque vidéo présente, en Libras, un récit qui propose un défi mathématique lié au domaine additif, basé sur des problèmes de composition. La méthodologie, de nature qualitative, comprenait la présentation de trois vidéos lors de deux réunions, auxquelles participaient des élèves sourds, un coordinateur de l'école et l'équipe MathLibras. Les données ont été produites en filmant les présentations et le matériel produit par les élèves. Pour analyser les vidéos, l'équipe a sélectionné quelques scènes considérées comme des événements critiques, dans lesquelles les élèves ont exprimé leur compréhension du défi proposé. En conséquence, nous pouvons mettre en évidence la perception d'erreurs visuelles lors du montage des images, qui ont conduit à des interprétations confuses de la part des élèves. L'un des enseignants a dû expliquer et écrire le calcul au tableau pour que les élèves comprennent l'affirmation proposée dans la vidéo. Grâce aux explications et aux exemples écrits au tableau, les élèves ont résolu de manière autonome le défi proposé dans la troisième vidéo L'évaluation de la réception a également souligné que les acteurs doivent signaler Libras plus lentement, à l'intention des enfants.

Mots-clés : Enseigner les mathématiques aux sourds, Langue des signes, Vidéo, Leçons vidéo.

Resumo

O presente artigo tem como objetivo descrever e problematizar as primeiras apresentações de três vídeos da Fase 1 do projeto *MathLibras* em uma turma de estudantes surdos do 3º ano do ensino fundamental, em uma escola bilíngue de surdos em 2022, localizada no RS. Cada vídeo apresenta, em Libras, uma narrativa que propõe um desafio matemático relacionado ao campo aditivo, a partir de problemas de composição. A metodologia, de caráter qualitativo, contou com a apresentação de três vídeos em dois encontros, nos quais estavam os alunos surdos, uma coordenadora da escola e a equipe do *MathLibras*. Os dados foram produzidos a partir da filmagem das apresentações e dos materiais produzidos pelos alunos. Para a análise dos vídeos, foram selecionadas algumas cenas consideradas como eventos críticos pela equipe, nos quais os alunos manifestaram seu entendimento para o desafio proposto. Como resultados, destaca-se a percepção de equívocos visuais na hora da edição das imagens, o que gerou uma interpretação confusa por parte dos alunos. Uma das professoras precisou explicar e escrever o cálculo no quadro para que os alunos compreendessem o enunciado proposto no vídeo. Com as explicações e exemplificações escritas no quadro, os alunos resolveram de forma independente o desafio proposto no terceiro vídeo. A avaliação da recepção também destacou que aos atores precisam sinalizar a Libras de forma mais lenta, visando o público infantil.

Palavras-chave: Ensino de matemática para surdos, Língua de sinais, Vídeo, Videoaulas.

MathLibras in 3rd-grade elementary school: First impressions on three videos of the project

Teaching mathematics is an art. This teaching can (and should) happen in different ways, possibly mediated by visual materials and technologies. In this line of action, this article presents the description and problematization of reception based on three videos from the *MathLibras* project we screened to a 3rd-grade elementary school class in a bilingual school for the deaf in a city located in the southern region of Rio Grande do Sul (RS).

Regarding the development of mathematical concepts by deaf children, Nunes et al. (2013) discuss the gap between them and listeners. The authors warn that:

> […] The mathematical gap found in deaf children can perhaps be explained by the limited frequency of interactions that stimulate the development of mathematical reasoning before they enter school. Preoccupied with language, the adults around them may not focus the attention necessary to promote the construction of informal mathematical concepts. (Nunes et al., 2013, p. 265)

However, Nunes et al. (2013) point out that several studies show the possibility of promoting the understanding of mathematical concepts among deaf children through interventions planned explicitly for them. In this sense, visual pedagogy, a possibility of planned intervention for deaf people, as it guides the need for educational processes involving deaf students to implement visual strategies or activities, can be an important perspective for thinking about teaching practices and materials.

Visual pedagogy assumes that deaf people, due to their visuospatial language, perceive, understand, and interact in the world differently from hearing people, that is, without hearing. Therefore, as Lacerda, Santos, and Caetano (2011, p. 108) point out:

> This centrality of visuality needs, in the education of the deaf, to permeate the development of the curriculum, teaching strategies, the organization of subjects, involving elements of artistic culture, visual culture, the development of plastic, and visual creativity pertinent to the visual arts, in addition to the use of computer resources -which are strongly visual- thus favoring an appreciation of the conception of the world constituted through subjectivity and objectivity with the "visual experiences" (Perlin, 2000) of deaf students.

Based on a learner's understanding of the specificities and visual demands of learning and understanding the world, the main objective of *MathLibras* is to produce videos with basic mathematics content, utilizing Libras as a language of instruction and textual production through visual resources and strategies to explain concepts, algorithms, among others, which can help deaf students in the process of learning and understanding mathematical content. The target audience of *MathLibras* is deaf children since early childhood education. The project videos are addressed to them, considering mediation from the teacher, and not as a video lesson for autonomous or independent learning. These are support videos for teachers and family members to use as an imagery and linguistic resource when interacting with deaf children.

The videos have simple animations and seek visual identification with children through the interaction of signaling deaf actors with two child characters: Sara and Levi. The characters experience a story narrated by the deaf signing actor, presenting a mathematical problem, a challenge they need help to solve. Thus, the videos contextualize the content using stories linked to students' daily situations, providing conditions for constructing concepts.

The videos are free of charge on the project's YouTube channel, and the productions are publicized on social media. However, despite many interactions via social networks with users who praise the productions, the team had not yet had the experience of seeing the videos used at school. At the end of 2022, the research group went to a school for the deaf and watched the presentation of three videos in a class of deaf children in the 3rd grade of elementary school. The children watched the videos and discussed and solved the challenges with the teachers. The activities were filmed and analyzed. This article explores how deaf students in the 3rd grade of elementary school at a bilingual school for deaf students received *Soma 3*, *Soma 8*, and *Soma 9* videos, focusing on problem situations of the composition of the additive field as content.

Mathematics, Libras, and Visuality

In this topic, some aspects of the relationship between mathematics, Libras, and visuality will be addressed based on the presentation of some YouTube channels that contain materials for teaching mathematics in/with Libras. The primary criterion for the channel search was the possibility of dialogue with the *Mathlibras* videos analyzed here. In other words, videos produced in Libras that present mathematics content for elementary school children.

In a brief search on the YouTube website –the main means of sharing videos on the internet today– with the terms "Matemática em Libras Anos Iniciais" [Mathematics in Libras Initial Years], we could find some individual channels publishing materials in Libras about mathematics teaching. No institutional channels dealing with this subject were found apart from glossaries on the content, such as those from Faculdade Uníntese (https://www.youtube.com/@unintese) and the Phala Institute (https://www.youtube.com/@institutophala).

Below, we present some examples of the results obtained for the search terms considering the work with addition, as this is the focus of the video applied and analyzed in this text. The videos used more general strategies without specifying the school stage or did not present visual characteristics aimed at the initial elementary school years.

The channel *O ensino-aprendizagem de matemática para surdos* [Teaching and learning mathematics for the deaf], available at https://www.youtube.com/@oensino-aprendizagemdemate1001, does not seem to be suitable for use with children in the early years, as the type of language, visual resources, and scenario do not match materials from this school stage. Even so, there is a video about addition in which the actor/signer explains the importance of knowing how to sum up, presents the concept, and the terms *portion* and *total*, besides giving an example using the purchase of toy cars as a motto.

The channel *Fundamental para todos* [Essential for everyone], available at https://www.youtube.com/@FundamentalParaTodos, deals with different subjects at this stage of basic education. Regarding mathematics, the videos feature more childish visual elements and interaction between the actress/signer. Regarding addition, the channel only has one video presenting a) the concept, b) the sign, and c) a context with an example through counting strawberries on a tray.

The channel *Professora Adriana - LIBRAS [Teacher Adriana - Brazilian Sign Language]*, available at the address https://www.youtube.com/@AdrianaReis1973, is the closest to the content of the initial years, but its channel refers to remote classes during the coronavirus pandemic period. The language is more childish, but the setting is traditional, with a whiteboard. The videos are lessons in Libras.

Removing some words from the search term and just inserting “Matemática em Libras” [Mathematics in Brazilian Sign Lenguage], a new search found, in addition to videos with glossaries about mathematics and from our channel, *MathLibras*, three other video options. At first glance, these channels seem to focus on working with basic mathematics, with a setting more aimed at children.

Starting from here, the channel *Sala 8* [Room 8], available at https://www.youtube.com/@Sala8, was created, according to the description on the YouTube platform, as “support for mathematics and Portuguese language classes” by the teacher who works as an actress/signer, Doani Bertan. Therefore, video organization has more visual elements, interaction with the setting, and activities to download in the video descriptions. Regarding the material that works with the summation content, it shows the concept and goes directly to a practical example with the help of visual resources inserted in the video editing. There is also a challenge that follows the context of the example and the downloadable material.

Another channel is *Matemática e Física em Libras* [Mathematics and Physics in Brazilian Sign Language], available at https://www.youtube.com/@lcnayres2008. This channel offers several videos in Libras but with content specific to the final years of elementary and high school, which we will not focus in this work.

Finally, *Zanubia Dada* is a deaf mathematics teacher who makes videos available on two YouTube channels. The most accessed and with the highest number of subscribers is: https://www.youtube.com/@zanubiadada7366. However, there are no videos in Libras on basic mathematics concepts for the early years, such as the one on addition that we sought in this research. The channel contains glossaries on the contents of this curricular component and disseminates the teacher's materials.

Given the results from the analysis of the materials available on the YouTube platform, *MathLibras*, especially *Soma 3, Soma 8, and Soma 9* videos can be considered close to the proposal of the channel *Sala 8* as a source of support materials for mathematics classes in the early years. Furthermore, as material available free of charge on the internet, *MathLibras* is designed to be used both in the classroom, with the teacher, during group activities, and at home as individual study activities for deaf students. This aspect differs from all the other channels listed and described so far, as it can help the teaching team plan and be used independently by deaf students at home.

The next topic is a discussion between mathematical language and its intertwining with Libras based on visuality.

The mathematical language and its intertwining with Libras from visuality

Regarding the videos analyzed in this article, we see that Libras plays a predominant role in the *MathLibras* project videos. The videos are designed and organized based on the structures that compose the visual and linguistic aspects of deaf people, what Lebedeff (2017) calls applied visuality.

> The visual experience cannot be seen only as an inspiring element of tools and support strategies but must tension an 'applied visuality', i.e., tension so that pedagogical practices, technological artifacts, curricular architectures school buildings for the deaf are problematized and proposed based on the understanding of visual experience. (Lebedeff, 2017, p. 248)

Based on this understanding, we demonstrate that inserting visuality beyond figures on the classroom walls or tangible materials to develop mathematical knowledge challenges educators. Libras is a visual language naturally acquired by deaf children and adults. Thus, including imagery or at least visually available elements and Libras in an accessible way for students contributes to their learning because it starts from the deaf community's understanding of the world.

In the same text, Professor Lebedeff (2017) analyzes the importance of using visuality in school practices and, consequently, in teaching materials: "It is easy to infer that schools provide meaningful school experiences that privilege this visual experience" (Lebedeff, 2017, p. 230), however, according to the author, there is still a lot of demand for visual pedagogical materials and practices. In the case of digital technologies, specifically videos, there are still few proposals in mathematics.

From the understanding of the role of visuality, of the linguistic elements that constitute the teaching of mathematics for the deaf, it is possible to perceive the strong relationship with Machado's proposition (2011, p. 16) about mathematical teaching and its intertwining with the native language, as for deaf people, learning and transmitting knowledge happen through Libras.

Machado (2011, p. 20) explains that this mutual impregnation can be easily perceived in teaching, a factor that reveals that, even if one tries to teach mathematical language in an inclusive way, this would imply a minimum knowledge of the native language. Therefore, the interdependence between native language (spoken or signed, as in the case of Libras) and mathematics teaching is relevant, indicating that knowledge of the language is fundamental for understanding mathematical concepts.

Libras is a visuospatial language that uses the body, vision, and space as communication tools (Gesser, 2009). Therefore, through these channels, communication develops (Quadros, 2019, p. 25).

Thinking about how this language was constituted and its legal recognition through Law 10.436 of 2002, we have to say: "Single paragraph: The Brazilian Sign Language - Libras cannot replace the written form of the Portuguese language." In this sense, although Libras plays an essential role in mediating the knowledge of the deaf community, its registration is present through the Portuguese language.

Therefore, the videos produced in the *MathLibras* project carry this strong parallelism in functions: they can be used in Libras as a native language and language of instruction for learning mathematical language, with Portuguese as a registration tool. Signed communication allows students to develop their understandings, interpretations, and mathematical reasoning. By enabling these mediations, videos contribute to the formation of concepts.

Below, we present a history of the *MathLibras* project and describe of the videos applied.

MathLibras and the videos selected for the presentation

The activities of the *MathLibras* project began at the Federal University of Pelotas[5] (UFPel) in June 2017, based on Call CNPq/MCTIC/SECIS n. 20/2016 – Tecnologia Assistiva, financed by the National Council for Scientific and Technological Development (CNPq), for 24 months (Grutzmann, Lebedeff & Alves, 2019a; 2019b; Grutzmann, Alves & Lebedeff, 2020).

This project continues to be developed at the Department of Mathematics Education of the Institute of Physics and Mathematics (Departamento de Educação Matemática do Instituto de Física e Matemática - DEMAT/IFM), in partnership with the Libras area of the Center for Literature and Communication (Centro de Letras e Comunicação - CLC), both at UFPel, Pelotas, RS. *MathLibras* has an institutional website and a YouTube channel, both publicly accessible.

The team has been changing over the six years of the project, keeping only the coordinators since the beginning. Currently, this team is made up of different participants: deaf and hearing teachers, sign language interpreter translators (TILS), master's and doctoral students from Postgraduate Programs in Mathematics Education (academic master's degree) and Humanities (academic master's and doctorate degrees), and students studying Cinema and Audiovisual, Animated Cinema, and mathematics teaching degrees. The team also includes teachers from the bilingual school for the deaf, a partner in the project since the beginning.

In the six years of *operation of the MathLibras*, completed in June 2023, it went through different moments called "phases." Figure 1 shows a synthesis of those phases.

[5] Omitted data will be included in the final version.

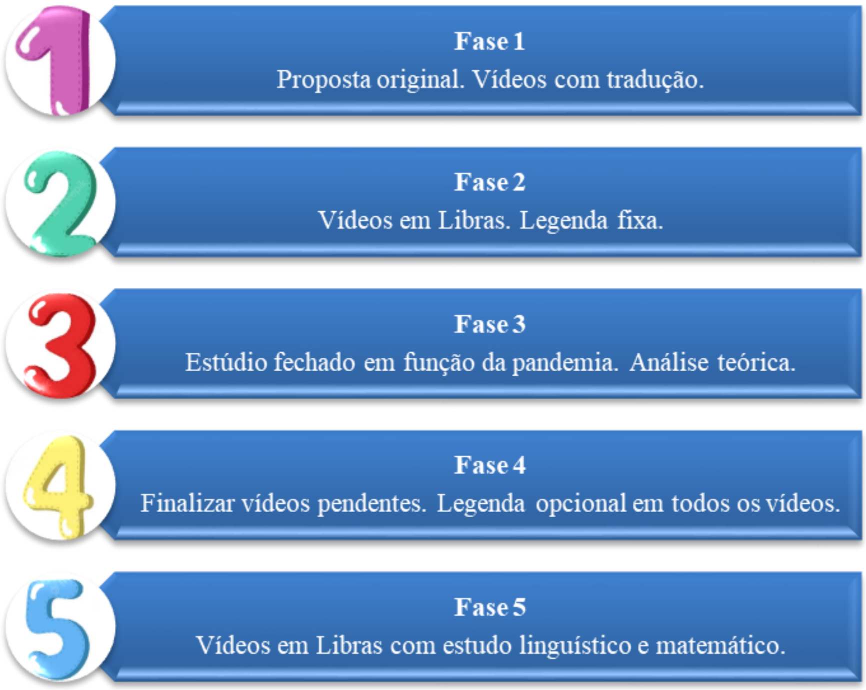


Figure 1.

MathLibras Phases

Phase 1, referring to the original proposal approved by CNPq, aimed to produce and make available video classes on mathematical content translated into Libras. The initial concept of translating videos in Portuguese into Libras was abandoned along the way, as the team later realized the unfeasibility of a straightforward translation.

At this stage, the three videos designed for summation covered the notions of the additive conceptual field, as per Gerard Vergnaud's conceptual field theory (2009). This theory "[...] considers that there are a series of factors that influence and interfere in the formation and development of concepts and that conceptual knowledge must emerge within problem situations" (Magina et al., 2008, p. 6). Furthermore, "[...] the understanding of a concept, however simple it may be, does not emerge from just one type of situation, just as a simple situation always involves more than a single concept" (Magina et al., 2008, p. 7).

In the additive field, additive structures can be classified in three ways: composition, transformation, and comparison (Vergnaud, 2009). And in each of them, there are several possible situations that vary in the level of complexity of the student's action on the problem.

From this perspective, the three videos made at this stage, namely, *Soma 3, Soma 9,* and *Soma 8,* despite the title *"Summation*", did not present a direct addition question for the children to solve; in addition, they had a whole story, a context for resolution. They are classified as composition problems, which "comprise situations involving part-whole – joining one part with another to obtain the whole, or subtracting one part from the whole to obtain the other part" (Magina et al., 2008, p 25). A detailed description of the videos will follow the text.

In Phase 1, the sequence of the main actions of the team, still in formation, was: 1) writing the script in Portuguese by the mathematics team, 2) recording the audio of the script, 3) recording the translation into Libras, trying to fit in the audio time, 4) editing and including animations, without subtitles. However, after recording the first videos (a total of seven), something bothered the team. Thus, we visited the National Institute of Education for the Deaf (Instituto Nacional de Educação de Surdos - INES) in 2018, seeking a dialogue about the production of signalized videos for deaf people, which happened with researchers Alexandre Rosado and Cristiane Taveira, coordinators of the research group Educação, Mídias e Comunidade Surda [Education, Media, and the Deaf Community].

In Phase 2, after INES researchers' instructions, the videos, whose actors were two deaf teachers and a TILS, began to be recorded in Libras. The sequence of actions changed a little: 1) writing the script in Portuguese by the mathematics team, 2) studying the script in relation to Libras terminology and recording, 3) recording the audio, 4) inserting the fixed subtitle, and 5) editing including animations. At this stage, nine videos were produced: two on fractions, one on multiplication, and six on addition. Just when the project was "picking up pace," the pandemic hit.

Thus, in Phase 3, between March 2020 and July 2022, the studio was closed. During this period, the team worked on analyzing videos already produced and writing articles (Grützmann et al., 2023), meeting weekly online. The group searched for a theoretical framework for this analysis, identifying points that needed to be rethought for the recording of future videos. One of the conclusions of this period is that the subtitles of the videos could not be fixed, a demand presented by Libras teachers at UFPel and by TILS who teach Libras and interpreter training courses so that the videos can be used as teaching material.

Phase 4 occurred in the face-to-face return after the pandemic, from August to December 2022. At this moment, with the team partially renewed, there were two fronts of action: i) editing and finalizing videos recorded in 2019 and, of a total of 12 pending videos, eight were finalized and the other four discarded; ii) insertion of optional subtitles (from YouTube, edited) in all videos. Thus, nine videos were reposted on the channel between September and November, with the option of optional subtitles, which justifies the presence of "repeated videos." Furthermore, the eight finished videos were posted on the channel between November 2022 and March 2023. Therefore, at this stage, there are 17 videos. As of 2022, there have been no new recordings.

From 2023 onwards, we began Phase 5 of the *MathLibras*. Now, all scripts are studied by the entire team before recording, focusing on the constituent elements of the signalized videos: a) the linguistic aspects of Libras, b) the position of the images and the animation, c) the writing of Portuguese for the audio and subtitles, considering the target audience and, d) the actor's positioning. In studying the script, we began to problematize the visual grammar for the signalized videos, according to Rosado and Taveira (2022). After the study and the finalized script, it was recorded in Libras with a mobile phone, which must be studied by the actor during the week so that the recording can be carried out the following week. Dos Santos Júnior (2022) highlights the importance of the script in Libras, as

> [...] in sign languages, the different terms and expressions use infinite combinations of parameters (configuration and orientation of hands, movement, location, and facial expression). Therefore, the script using written language cannot express the sign language complexity (Dos Santos Júnior, 2022, p. 53).

In this way, what would previously be a script in Portuguese, came to be seen as an "initial idea" developed by the mathematics team, which leads the discussion of the proposal to be thought in Libras, in such a way that the result of the discussion is the production of a script in Libras that is filmed to be rehearsed by the signalizing actor during the week before the official recording.

In the year 2023, the *MathLibras* has two work fronts: i) the deaf teacher who participates in the project is recording videos about the concept of comparison, linked to the construction of the concept of numbers and, ii) one of the participating TILS, a Libras teacher, is recording videos about fractions. Considering the sequence of the main actions, at this moment, we can list: 1) writing the initial idea in Portuguese; 2) studying the initial idea in Libras; 3) recording the script in Libras; 4) recording the signalized video with support in Libras; 5) translation of the video into Portuguese (basis for audio and subtitles); 6) audio recording; and 7) editing with the inclusion of animations and the insertion of optional subtitles. At all times, translation from Portuguese-Libras-Portuguese always takes place, making the process complex.

It is essential to introduce the *MathLibras* characters in the video: Levi and Sara. They are curious children, who are in the early years of elementary school and really enjoy learning mathematics. In Figure 2, the initial version of the characters appears on the left, and the current version, on the right, produced in 2023 by the extension scholarship holder linked to the *MathLibras*.

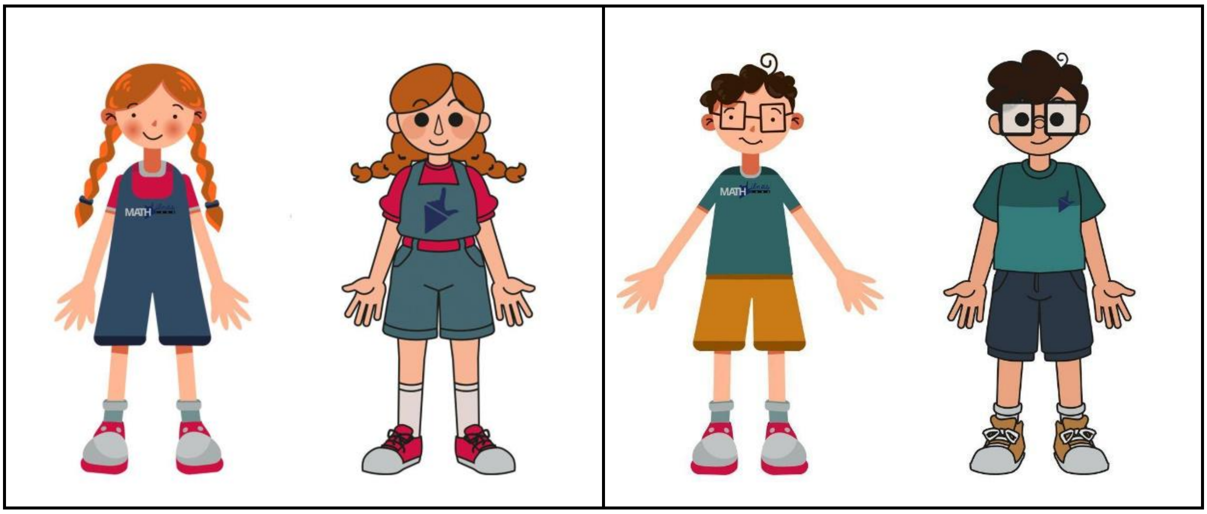


Figure 2.

Versions of Sara and Levi

In some videos, Levi and Sara interact more, becoming part of the story. In others, they just help resolve a challenge. The idea is that deaf children identify with the characters and, just like them, want to solve the mathematical challenges.

Next, Chart 1 presents all the videos published on the YouTube channel, indicating the content explored and the respective phase of its production.

Table 1.

MathLibras videos

Video	Content	Phase	Published
V01 - Classify for what? - Video 1	Classification	1	Feb/2018
V02 - Classify for what? - Video 2	Classification	1	Feb/2018
V03 - Classify for what? - Video 3	Classification	1	Mar/2018
V04 - Classify for what? - Video 4	Classification	1	Mar/2018
V05 - Addition - Soma 9 [Emojis]	Additive Field	1	May/2018
V06 - Addition - Soma 8 [Carts]	Additive Field	1	Apr/2018
V07 - Addition - Soma 3 [Books]	Additive Field	1	Apr/2018
V08 - Fraction - Initial ideas 1 (Subtitled)	Fractions	2	Aug/2018
V09 - Fraction - Initial ideas 2 (Subtitled)	Fractions	2	Aug/2018
V10 - Subtraction 2 (Subtitled)	Additive Field	2	Sep/2018
V11 - Subtraction in Libras - Subtraction 7 (Subtitled)	Additive Field	2	Mar/2019
V12 - Soma 7 (Subtitled)	Additive Field	2	Apr/2019
V13 - Subtraction 6 (Subtitled)	Additive Field	2	May/2019

V14 - Soma 6 (Subtitled)	Additive Field	2	Jun / 2019
V15 - Soma 5 (Subtitled)	Additive Field	2	Sep/ 2019
V16 – Multiplication (Subtitled)	Multiplication	2	Oct/2019
V17 - Fraction - Initial ideas 1	Fractions	4	Sep/2022
V18 - Fraction - Initial ideas 2	Fractions	4	Sep/2022
V19 - Subtraction 2	Additive Field	4	Sep/2022
V20 - Subtraction in Libras - Subtraction 7	Additive Field	4	Sep/2022
V21 - Soma 7	Additive Field	4	Sep/2022
V22 - Subtraction 6	Additive Field	4	Sep/2022
V23 - Soma 5	Additive Field	4	Nov/2022
V24 - Soma 6	Additive Field	4	Nov/2022
V25 – Multiplication	Multiplication	4	Nov/2022
V26 - Toy Store	Additive Field	4	Nov/2022
V27 - A garden for Sara - SOMA 9	Additive Field	4	Nov/2022
V28 - Everything ends in Pizza - FRACTION 3	Fraction	4	Dec/2022
V29 - Clippings - Multiplication	Multiplication	4	Dec/2022
V30 - War of the Pens - COMPARISON	Additive Field	4	Dec/2022
V31 - Neighbors	Predecessor and Successor	4	Feb / 2023
V32 - Golden Material	Golden Material	4	Feb / 2023
V33 - Golden Material II	Golden Material	4	Mar/2023
V34 - Let’s Compare?	Comparison	5	Mar/2023
V35 - Comparing Dolls	Comparison	5	Apr / 2023
V36 - Comparing Trains	Comparison	5	Apr / 2023
V37 - Reading Fractions 1	Fractions	5	Jul/2023
V38 - Reading Fractions 2	Fractions	5	Jul/2023
V39 - Fractions Challenge 1	Fractions	5	Jul/2023
V40 - Fractions Challenge 2	Fractions	5	Jul/2023
V41 - Fractions Challenge 3	Fractions	5	Jul/2023
V42 - Fractions Challenge 4	Fractions	5	Jul/2023
V43 - Fractions Challenge 5	Fractions	5	Jul/2023
V44 - Fractions Challenge 6	Fractions	5	Jul/2023

V45 - Fractions Challenge 7	Fractions	5	Jul/2023
V46 - Fractions Challenge 8	Fractions	5	Jul/2023
V47 - Fractions Challenge 9	Fractions	5	Jul/2023
V48 - Fractions Challenge 10	Fractions	5	Jul/2023

In this context, only in 2022, after the return of the pandemic, the team at *MathLibras* organized the presentation of some videos with the project's partner school. The first video presented to deaf students was the *Soma 3*, on September 15th, and the other two videos were *Soma 8* and *Soma 9*, on September 22nd. The videos are from Phase 1 of the project and will be presented below.

The Soma 3 video

Soma 3 video was recorded in Phase 1 and lasts 2min27s. The logos are presented in the first ten seconds. Soon after, two actors appear: the deaf actor on the left and the hearing actor on the right. The hearing actor introduces himself and, shortly after, the project, which the deaf actor translates until 38'. From 0'39" to 0'44", the title of the video shows.

From there, the narrative begins: Sara went to school, as she does daily. At school, she decided to borrow two books from the library. At home, she shows her mother the two books she had brought and her mother states that she now has three books (Figure 3).

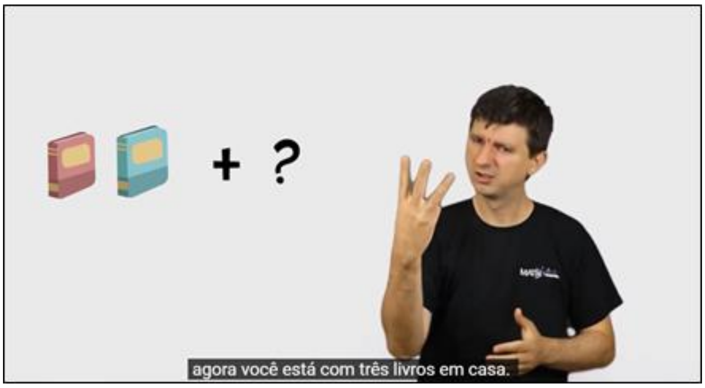


Figure 3.

Beginning of the story - Soma 3

Sara goes to her room to look for how many books were left to add to the ones she had brought from school and reach a total of three, as her mother said. At that moment, the video shows the question: "*Can you tell me how many books Sara found?*" (Figure 4).

Figure 4.

How many books did Sara find?

The deaf actor counts: one, two, plus one equals three. So, the actor concluded that Sara already had a book at home (Figure 5).

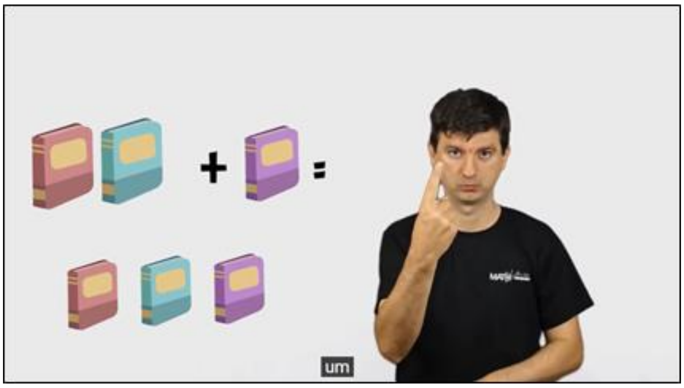


Figure 5.

Sara had a book at home

At 1’50”, the actor leaves the scene, and the mathematical calculation and the iconic representation with hand signs in Libras appear. This image remains on screen for four seconds (Figure 6).

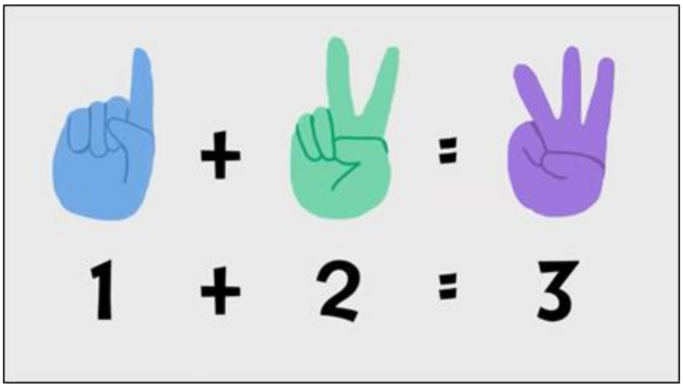


Figure 6.

Representation of the calculation 1+2=3

At 1’54”, the two actors return, asking if the viewers liked the video. At 2’03”, we have the credits.

Soma 9

The video *Soma 9* was also recorded in Phase 1 and lasts 2’33”. The logos are presented in the first ten seconds. Soon after, two actors appear: the deaf actor on the left and the hearing actor on the right. The hearing actor introduces himself and, shortly after, the project, which the deaf actor translates until 38’. From 0’39” to 0’44”, we see the title of the video.

From there, the narrative begins: Levi goes to the playground to play. The game is to compete for superhero stickers. Before starting, Levi counted his stickers, five (Figure 7).

Figure 7.

Beginning of the story - Soma 9

After playing, Levi counted his stickers again, and now, he had nine (Figure 8).

Figure 8.

Levi with nine stickers

Next, the video question is presented: “*How many stickers did he win?*” Thus, the actor proposes to count. As he already had five, he uses this information and counts: six, seven, eight, nine. And he concludes that he won four stickers (Figure 9).

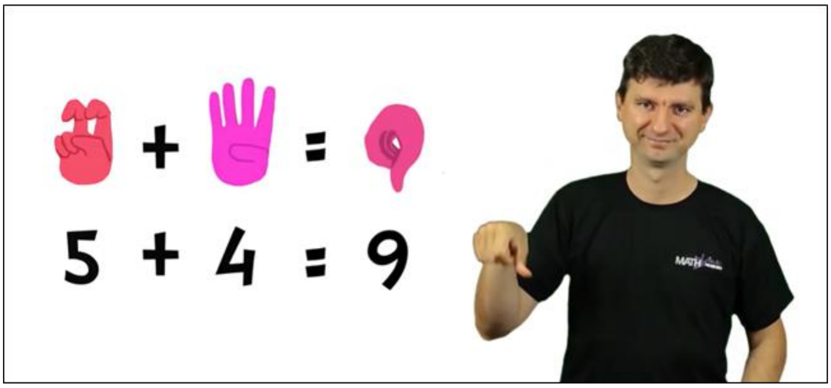


Figure 9.

Levi won four stickers

At 1’58”, the actor leaves the scene, and all that is left is the calculation and the iconic representation with hand signs in Libras. This image remains on screen for two seconds (Figure 9). At 2’, the two actors return, asking whether the viewers liked the video. The credits appear from 2’10” onwards.

Soma 8

Soma 8 video, recorded in Phase 1, lasts 2’32”. The logos are presented in the first ten seconds. Soon after, two actors appear: the deaf actor on the left and the hearing actor on the right. The hearing actor introduces himself and, shortly after, the project, which the deaf actor translates until 38’. From 0’39” to 0’43”, we see the video title.

At 0’44”, the narrative begins: Levi has a toy car to play with. After his birthday party, he opens his presents and realizes that now he has eight toy cars (Figure 10).

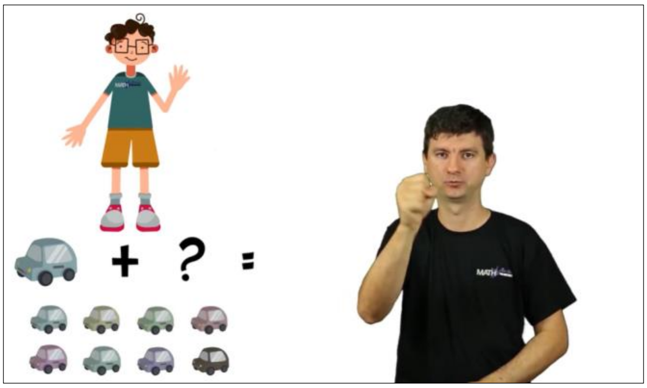


Figure 10.

Levi has eight toy cars

The actor counts the eight toy cars, which “flash” during the count. “*If Levi had a toy car and ended up with eight, how many did he get?*” Next, the actor counts the toy cars that Levi won, from one to seven, concluding that he got seven (Figure 11).

Figure 11.

Levi won seven toy cars

In the previous figure, you can see the seven toy cars Levi won. Finally, at 1'52", the representation of the calculation begins, ending at 2' (Figure 12).

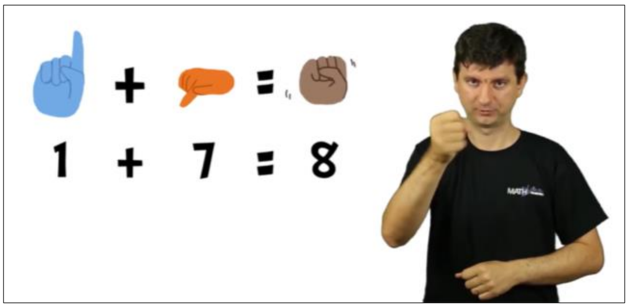


Figure 12.

Calculation 1+7=8

At 2', the two actors return, asking whether the viewers liked the video. The credits appear from 2'10" onwards.

The three videos described here were considered problem situations for the composition of the additive field. Those situations have the following diagram model (Figure 13) according to conceptual field theory (Magina et al., 2008):

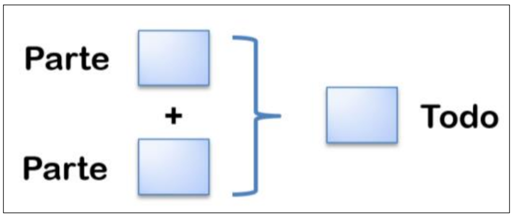


Figure 13.

Diagram model for composition problems

Usually, the first composition problems that are worked on with students in their initial years at school ask for the calculation of the whole based on the values of the parts. For example: *In Dona Maria's house, there was an aquarium with 3 green fish and 5 blue fish.*

How many fish were there in the aquarium? The teachers of the Alfredo Dub school had already worked on that kind of problem with their 3rd-grade students.

However, the three *MathLibras* videos taken to the 3rd-grade class present the whole and ask for the calculation of one of the parts. See Figure 14.

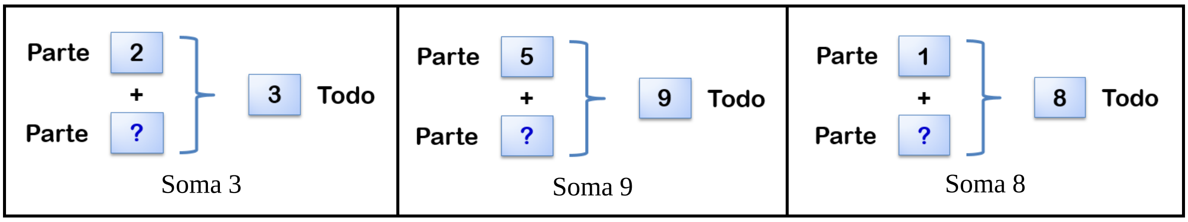


Figure 14.

Diagrams of the Soma 3, Soma 9 and Soma 8 videos

In this way, these *MathLibras* videos are more complex and are not recommended for students in the 1st and 2nd grades of elementary school, the target audience intended for their production, according to the results found in Ribeiro's research (2022). This author highlights:

> [...] Summarizing the analysis, we highlight that in the teachers' view, the use of the video "Soma 3" to teach mathematics to deaf children in the 1st and 2nd grades of elementary school is interesting, but both were unsure whether it should be used in these segments. The teachers hypothesized using the video with children in later grades, as they both thought that it would not be easy to understand for children in this age group, which, in fact, is correct, as this type of problem should be used with children from of the 3rd grade of elementary school. (Ribeiro, 2022, p. 51)

Aligned with Ribeiro's (2022) result, in the National Common Curriculum Base (Base Nacional Comum Curricular - BNCC), this type of skill is only developed from the 3rd grade onwards, as shown in Table 2, which presents the objects of knowledge and skills related to addition in the three grades.

Table 2.

BNCC skills

Objects of Knowledge	**Skill**
Problems involving different meanings of addition and subtraction (join, add, separate, remove)	(EF01MA08)- Solving and creating addition and subtraction problems involving numbers of up to two digits, with the meanings of joining, adding, separating, and removing, with the support of images and/or manipulative materials, using strategies and forms of personal registration. (Brasil, 2018, p. 279)
Problems involving different meanings of addition and subtraction (join, add, separate, remove)	(EF02MA06) Solving and creating addition and subtraction problems involving numbers of up to three orders, with the meanings of joining, adding, separating, and removing, using personal strategies. (Brasil, 2018, p. 283)

Problems involving the meanings of addition and subtraction: joining, adding, separating, removing, comparing, and **completing quantities**.	(EF03MA06) Solving and creating addition and subtraction problems with the meanings of joining, adding, separating, removing, comparing and **completing quantities**, using different exact or approximate calculation strategies, including mental calculation. (Brasil, 2018, p. 287)

Source: BNCC (2018)

Therefore, after disclosing *MathLibras* and the three videos used, we describe the data production and analysis methodology.

Methodology

The research proposed here is of a qualitative and descriptive nature (Paiva, 2019), whose process is fundamental, i.e., the group was concerned with students' reception of the videos, seeking to infer the potential that they have to enable (or not) the understanding of the challenge proposed in each of them. The study of reception, as Vieira and Rezende Filho (2022) argue,

> […] Starts from the idea that the viewer of an audiovisual work has an active role in constructing meaning. Certainly, the message carries meaning control mechanisms, depending on the coding processes and display contexts, but understanding why they are accepted, negotiated, or opposed means dialoguing with the receiver and thus being able to understand their interpretations and needs. (Vieira & Rezende Filho, 2022, p. 10)

For data production, analysis, and processing, we chose to use the analytical method proposed by Powell et al. (2004), which, according to Powell and Silva (2015), presents seven interactive non-linear phases: 1) observe the video data, i.e., watch the video attentively several times; 2) describe the video data in a direct, non-interpretive way, and separating them according to time, meaning, or situation; 3) identify critical events, i.e., those that demonstrate "a significant or constant change in relation to a previous understanding" (Powell et al., 2004, p. 104); 4) transcribe critical events; 5) code, a phase dedicated to analyzing and identifying the contents/themes of critical events; 6) build a plot, at which point the organization of critical events is proposed through codes; and 7) compose narrative, observation of the whole formed by the seven phases.

The meetings took place in a bilingual school for the deaf, on September 15th and 22nd, 2022, with the 3rd-grade elementary school class. The *MathLibras* coordinators applied the methodology together with the scholarship holders, cinema, and audiovisual undergraduates. The class teacher and the school coordinator, who participates in the *MathLibras*, were also in the room. It is vital to highlight that the school management authorized the *MathLibras* team to present and discuss the videos; also, the students' faces were covered to preserve their identity.

The 3rd-grade class had six students, identified here as Students 1 to 6, respecting gender, who will be presented in Chart 3, organized from 1 to 6 according to age.

Table 3.

The 3rd-grade class

Student	**Diagnosis**	**Linguistic level in Libras**	**Age (y/m)**	**At school since**
Student 1 (girl)	Deafness	Fluent	8 y and 7 m	10/2015
Student 2 (girl)	Deafness	Advanced	9 y and 4 m	02/2018
Student 3 (boy)	Deafness	Advanced	10 y and 2 m	04/2018
Student 4 (girl)	Deafness	Basic	10 y and 3 m	12/2016
Student 5 (girl)	Deafness	Intermediate	11 y and 5 m	03/2017
Student 6 (boy)	Deafness	Basic	11 y and 7 m	06/2016

Source: School data, September 2022.

In relation to the linguistic level, there is significant heterogeneity within the class, which ranges from students with a basic level in Libras to advanced users of the language, in line with the descriptors of the Common European Framework of Reference (CEFR) for Languages (Conselho da Europa, 2001). According to Sousa et al. (2020), this document was published in 2001 by the Council of Europe and is used in several countries as a reference for the teaching and assessment of second language (L2) and foreign language (FL). It shares the basis for the development of the syllabuses, curriculum guidelines, tests, assessments, textbooks, and other language teaching materials.

For sign languages, a project called *Prosign* (Leeson et al., 2016) developed a specific chart. *Prosign* is an offshoot of the CEFR for teaching European sign languages. *ProSign* basically follows the same proposal as the CEFR, with the inclusion of specific aspects of sign languages. In Brazil, a team of researchers from the Federal University of Santa Catarina (UFSC) translated and adapted both frameworks, developing a reference framework for teaching Libras as an L2 (Sousa et al., 2020), called "Framework of Reference of Libras as

L2". In Brazil, no reference framework indicates the linguistic skills and competencies expected of a user of Libras as L1. Therefore, we will use the references from the L2 indicative framework so that it is possible to understand the linguistic development of children when carrying out the research.

Basic level students, according to the references presented by Sousa et al. (2020), are classified as "elementary user", that is, the individual begins to produce simple sentences. The signer already knows the essential characteristics of the language and uses them in simple contexts. The intermediate level indicates a user who can interact briefly on topics of personal and family interest. The signer is learning more aspects of sign language. Your interlocutor needs to keep signaling paused. The advanced level describes a user who understands sign language very well and signs naturally. Furthermore, the user can argue with great argumentative and critical sense. Student 1, reported as fluent, can be described as a "master or proficient user." In this case, the signer can use sign language in different areas. It is worth noting that the student is a native Libras speaker.

At the first meeting, we presented the video *Soma 3*, and on the second meeting, the videos *Soma 8* and *Soma 9*. The video presentations were similar. The students were taken to the mathematics room, where there is a flat-screen television. They sat in an "L" shape, according to the layout of the classes, facing the board and the TV (next to the board).

The academics positioned the camera on the *MathLibras* below the TV, capturing the image of the students from the front. Another recording was made on a mobile phone, positioned behind the students, to capture the teachers' interactions.

At the first meeting, one of the coordinators started the conversation in Libras by introducing herself, introducing the team, and explaining why we were there. Then she explained that we had a video for them to watch and that after that, we would like to know whether they understood the story, knew how to answer the challenge, and what they thought of it, whether they liked it or not. On that day, five students were present.

At the second meeting, as had happened the previous week, after the initial greetings, we said that we would broadcast two videos similar to the one they had watched the meeting before and that each had a challenge. On that day, only three students were present.

After the text, we problematized each application, describing the students' reactions, the development of actions, and the analysis of the results.

Discussion and analysis of results

The presentation of the *Soma 3* video was on September 15, 2022, with the presence of all students from the 3rd-grade class of the bilingual school, a partner in the project. The teacher asked them to look carefully, as there was a question at the end.

The video was edited to “skip” the initial information. Thus, it started at 45” and was paused when the actor asked the question at 1’30”, with the following image (Figure 15):

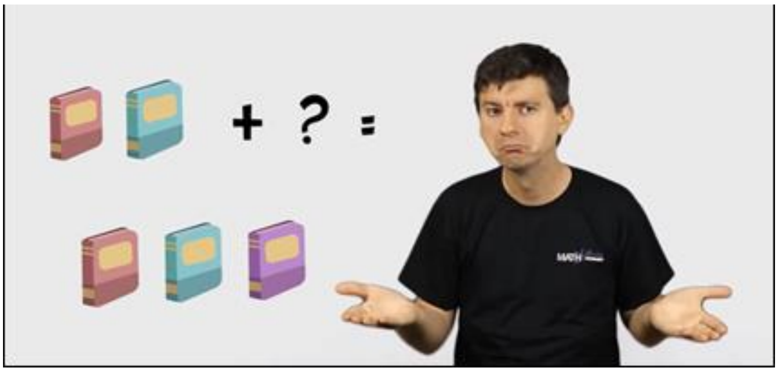


Figure 15.

Challenge - Soma 3

During the presentation, thirteen people were in the room: five children, the two project coordinators, four cinema and audiovisual undergraduates (with two video capture devices), the class teacher, and the school coordinator (Figure 16).

Figura 16.

Application scenario

Figure 16 shows the tables arranged in an “L”, the board in front, and the TV next to the board. Below the TV is the *MathLibras* project camera. This image refers to the coordinator’s mobile phone placed behind the students.

In the frontal video the cinema students recorded for as long as 12’50”, we noticed some moments in which the students interacted, offering responses to the challenge, which will be presented and discussed, defined as critical events as per Powell et al. (2004).

At 4’35”, the first critical event is identified because Student 1, after watching the first video and as soon as the question is asked, “*Can you tell me how many books Sara found?*” raises her right hand, signaling the number “5” (Figure 17).

Figure 17.

First answer: 5

In the research carried out by Sales (2008 apud Borges & Nogueira, 2013, p. 8), we found something similar because “[...] in the additive problems, the researcher noticed that the students used to add the numbers present in the problems without understanding the situation, which caused errors since additive problems involve both additions and subtractions.”

The video is displayed again. Next, the school coordinator, realizing the students could not understand, went up to the image and explained the situation. When asking the students what the answer was, the result “3” (6’43”) was obtained from Students 1 and 2, and shortly afterward, Student 3 signaled “1” (6’46”), a fact that went unnoticed by the team (Figure 18). This is the second critical moment defined by the team.

Figure 18.

Answers “3” and “1”

It is possible to see the answers “3” and “1” from another angle, from the video captured by the mobile phone behind the children. (Figure 19)

Figure 19.

Answers “3” and “1” from another angle

Then, the coordinator explains the question again, and the three students answer “5” and “3” several times, giving the impression that they did not understand the question. At 7’54”, Student 1 answers with the value “8” (Figure 20). This is the third critical event. There is a change, a rupture, although it is not yet the response expected by the team.

Figure 20.

Answer 8

While the explanation is repeated for the students, in the background, the *MathLibras* coordinators ask the undergraduates whether they realize what is happening there: that the students are considering the values “2” and “3” that appear in the animation as the parts of the addition, which should be added, that is why they are answering “5.” In this sense, the first problem with the animation is detected, as the addition portions are in the first line, and the result is in the second, which is not a usual writing language in mathematics, thus confusing the students. The calculation needs to appear linearly, with the portions and the result on the same line, or with the algorithm, where each portion occupies a line, and the result is given on the following line.

Furthermore, the challenge brings the result, number “3”, and demands the value of one of the portions, which is also unusual in the first grades of elementary school. In their research, Nunes and Bryant (1997) state how important is the basic conceptual understanding of addition and subtraction operations, far beyond just performing arithmetic operations.

At 9’04”, the coordinator asks for a pen and then goes to the board to draw the context of the problem. From the drawing on the board, Student 1 understands it immediately (9’31’), signaling “1” as the result of the question (Figure 21).

Figure 21.

Correct answer - value “1”

In this situation, the team realized that the linearity of the coordinator’s explanation on the board, compared to the video visuality (Figure 22), was fundamental for students’ understanding.

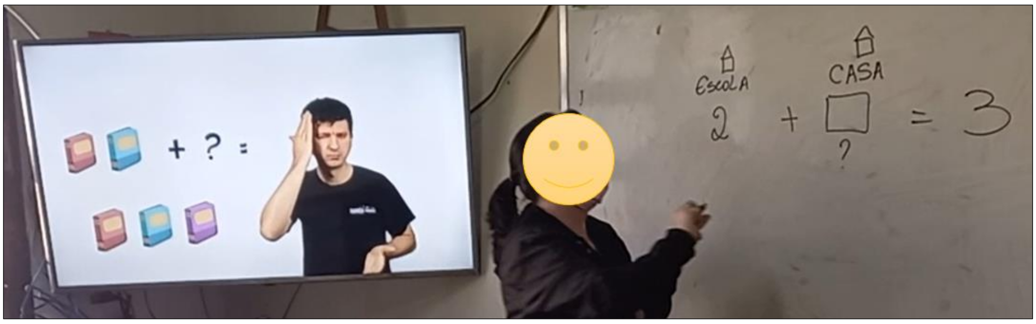


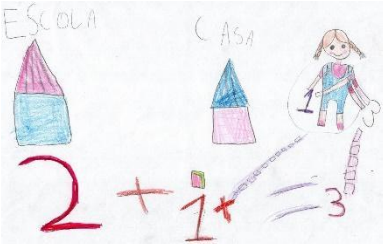
Figure 22.

The linearity of the coordinator’s explanation

Next, when asked if they found the video difficult, the students answered: “*more or less*.” In other words, although the calculation itself is simple, 2+1=3, the structure of the problem behind the calculation requires not-so-trivial reasoning as it addresses composition, in which the student must calculate one of the parts given the value of the other part and the whole

(Magina et al., 2008). As the image did not facilitate interpretation, the video presents problems that the team must rethink.

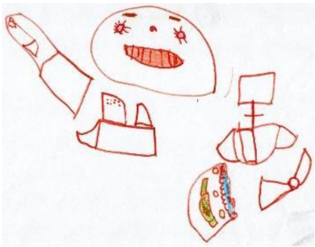
At the end, students were asked to draw the story of the video. Figure 23 shows their drawings. It is possible to see that the representation of Students 1, 2, 3, and 6 is close to what the teacher explained on the board (Figure 22).



Student 1 (girl)

Student 2 (girl)


Student 3 (boy)


Student 4 (girl)


Student 6 (boy)

Figure 23.

Student production

The following week was the time for applying video *Soma 9*. The application site was the same, maintaining the position of the cameras. In the frontal video recorded by the cinema undergraduates for 5’52”, we noticed some moments in which the students interacted, which will be presented and discussed.

At 2’32”, Student 3 starts counting, and at 2’39”, he signals “14”; i.e., the quantities of images were counted again, which the team characterized as the first critical event of the day (Figure 24). The student keeps signaling until 2’53”, but the team does not notice it. They identified it only later when looking at the recordings.

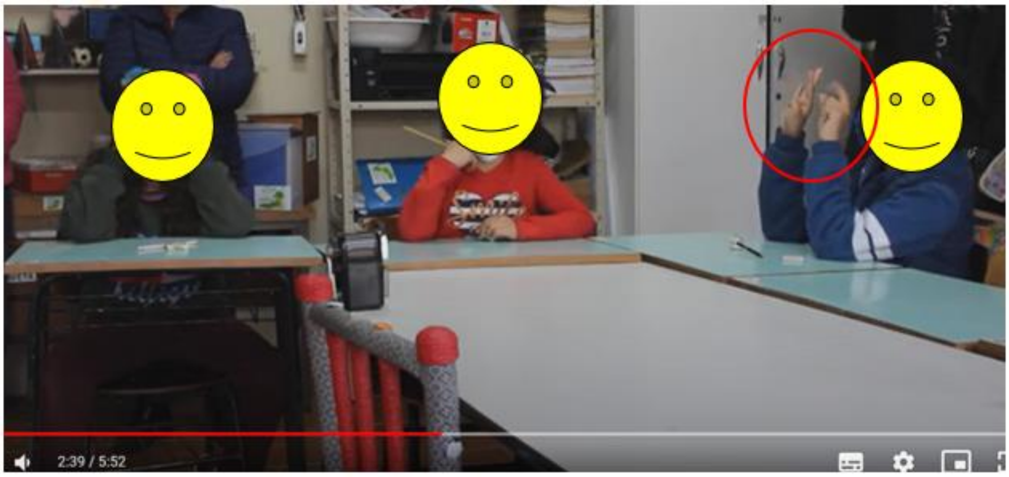


Figure 24.

Student 3 counts

At 3’01”, this student touches his colleague, showing her the result “14” but she ignores him. At 3’24”, this student starts counting all the stickers that appear on the screen and also reaches the result 14, at 3’40”. In the background, one coordinator comments: “*They added it again!*”, in disappointment.

The school coordinator goes to the board to explain the video’s narrative, and at 4’43”, Student 2 draws attention and explains: “‘5’ plus something, which is ‘4’” (Figure 25). It showed the expected answer, which is highlighted as the second critical event.

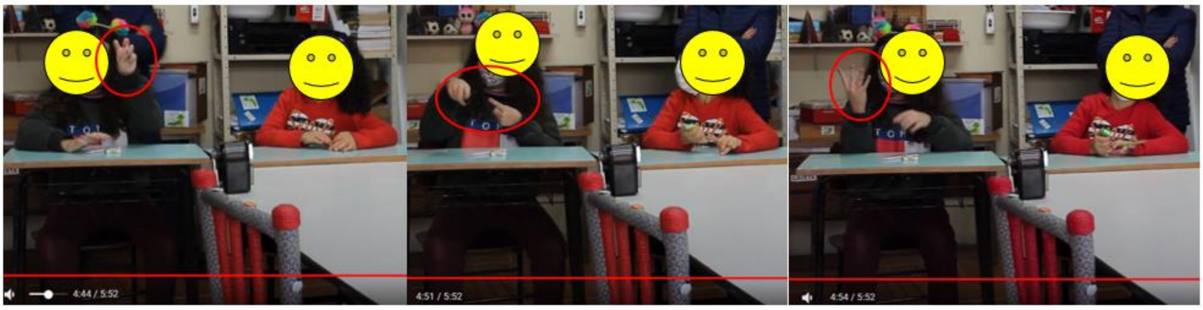


Figure 25.

The count made by Student 2

She then turns to his colleague and explains her reasoning but decides to get up and go to the TV to show the elements and present her calculation (Figure 26). Student 2 explains that the number “4” should replace the question mark.

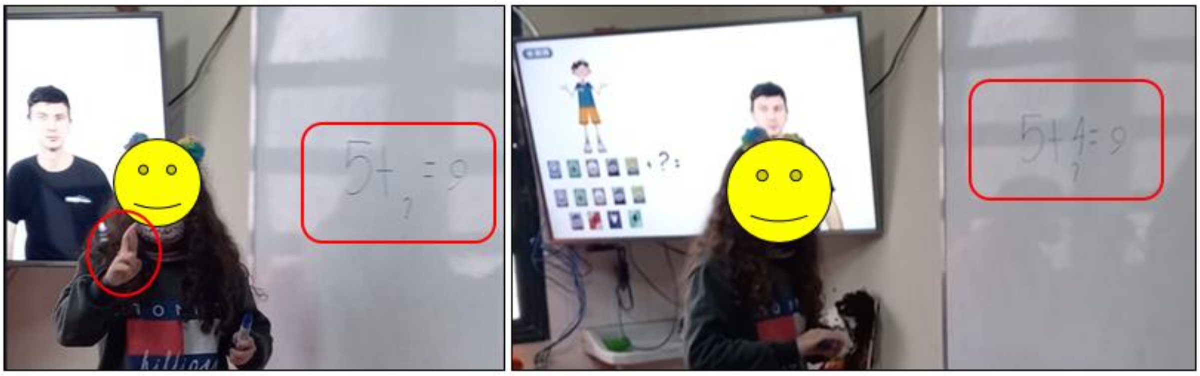


Figure 26.

Student 2's explanations

"*How did you understand?*" asked the coordinator in Libras. The student replied: "*It was visual*." In other words, she corresponded card by card, using colors and designs, realizing that they had "4" new ones (Figure 27).

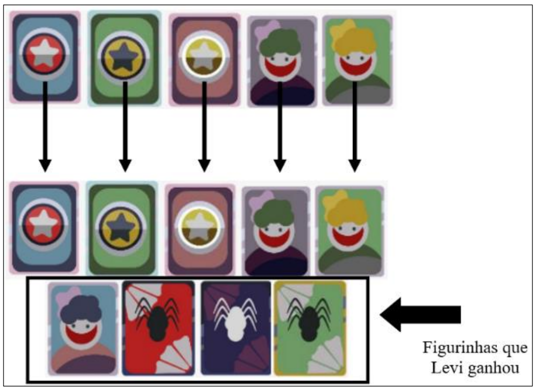


Figure 27.

Correspondence between the cards

Regarding the visuality of deaf people, Campello (2008), a deaf researcher, highlights that:

> Deaf subjects are subjects mediated by different references from those of non-deaf people. They gradually become aware that "their world" is a world without sound, and they do not feel uncomfortable because they cannot hear [...] the absence [of sound] is replaced by vision, which is conditioned according to the visual perception that is being built in and from the world. (Campello, 2008, p. 86)

In the video of *Soma 9*, after the students understood the problem, all retold the story, explaining the calculation carried out and confirming their learning. This fact was analyzed in a second video, which lasted 10'01".

Next, we showed *Soma 8*. The first time, Student 2 manages to solve it, characterizing the first critical event of this video. She gets up (48"), goes in front of the TV, and signals the number "7" with her hand in place of the question mark (Figure 28).

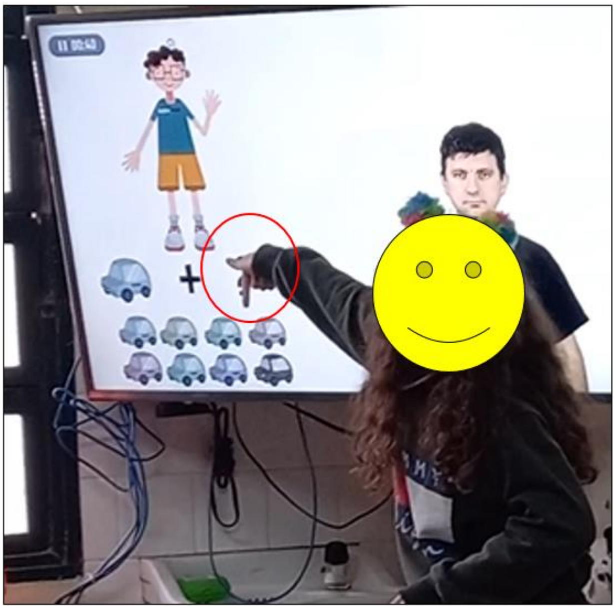
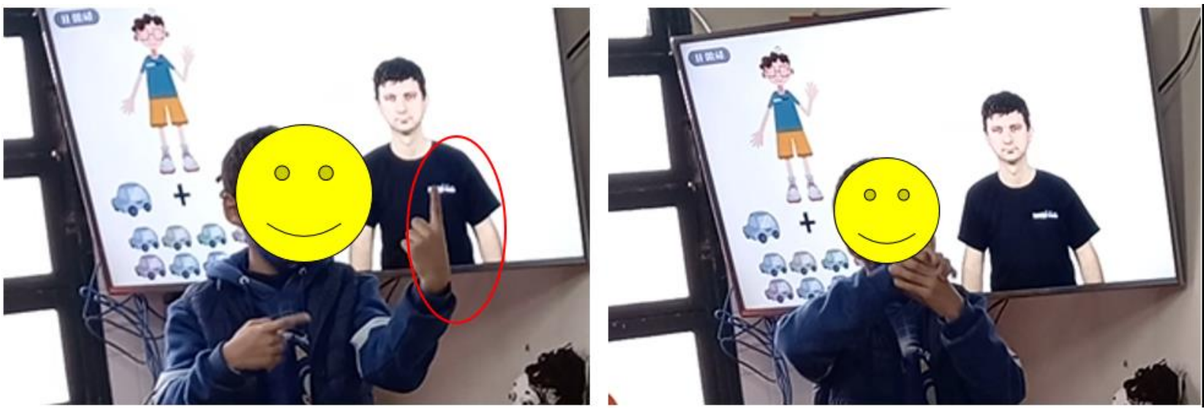


Figure 28.

Student 2's answer

The student does not explain, just signals that the answer is "7". She probably had a similar reasoning to the problem of *Soma 9*, made a few minutes earlier.

Student 3 gets up and also goes to the TV (1'06"). Figure 29 shows a sequence of images with his explanation.



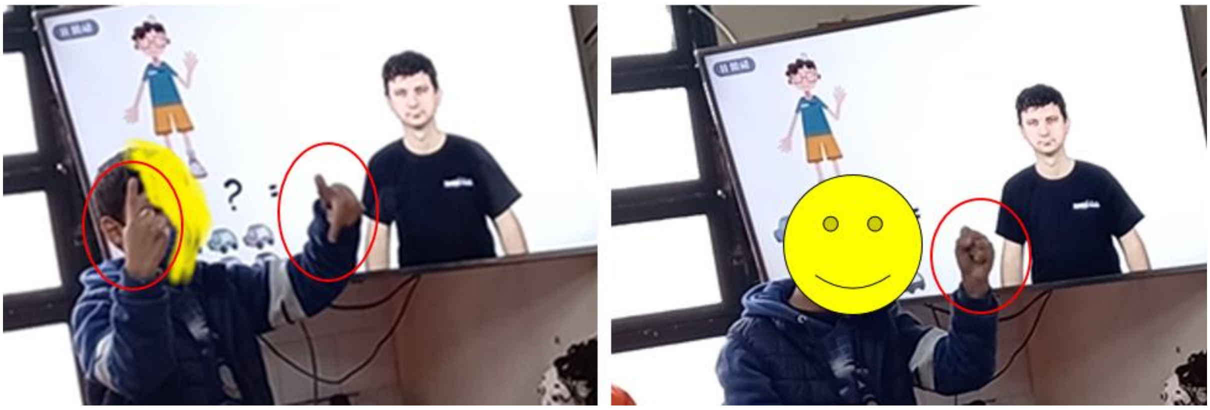


Figure 29.

Student 3's explanation

The student returned happily to his seat, as he managed to explain "correctly" (1'32"). Student 1 was upset because everyone already understood, while she didn't explain (1'42"), which was another critical event. Then, the coordinator asks some students to signal that they did not understand (2'03"), but Student 1 is unconvinced. The class teacher, who is monitoring the situation, argues: "*I think it's 5*" (2'21"), and the student shyly shakes her head negatively and shows the number "7" (2'25"). Then, Student 3 gets up and goes next to the TV to explain (2'30"), based on the class teacher's question, "*Why is it 7?*": "*Because it has 1, 2, 3, 4, 5, 6, 7, 8. Then remove the one at the top, there are 7. The result is 8.* "

Thus, the three students could understand the *Soma 8* video composition problem directly from the video without needing an explanation from the coordinator, as in the other two. According to Nunes et al. (2009, p. 80), "[...] When the child manages to coordinate their practical activity with counting, they become capable of solving simple addition and subtraction problems."

To conclude, after watching the videos, the students received a sheet of paper to solve the questions. Nunes et al. (2009, p. 68) highlight that "[...] Teachers must find ways to get students to record their problem-solving strategies so that they can be discussed, validated, and compared with each other". Thus, on this sheet, they received the problems based on statements organized in short form and with visual aids. Figure 30 shows the three students' answers.

Student 1 (girl) Student 2 (girl) Student 3 (boy)

Figure 30.

Activities carried out

When analyzing the calculations the students developed, we realized that they understood the challenges and organized the mathematical sentences correctly. When arranging the problems, we opted for a more visual structure with short sentences, which would facilitate deaf students' reading and understanding. This idea was inspired by Nogueira and Soares (2019), based on adapting additive problems. Furthermore, "[...] One of the most significant functions of mathematical education is to promote the coordination of action schemes and reasoning that the child develops outside the classroom with the representations that are part of the mathematical culture" (Nunes et al., 2009, p. 48).

Nogueira and Zanquetta (2013, p. 39) state that "The school should not be limited to "translating" regular school methodologies, strategies, and procedures into sign language, but should continue to be concerned with organizing activities that provide a qualitative leap in the thinking of deaf people."

Considerations

Deaf visuality and the visual power of sign language have tensioned discussions about specific ways of teaching and learning, called visual pedagogy, deaf pedagogy, and bilingual pedagogy. According to Digiampietri and Matos (2013), these terms are interchangeable among scholars in the field and have very similar meanings. The three indicate specificities for teaching deaf subjects, in which sign language and its visual characteristics are explored and become the center of pedagogical practice.

Visuality for mathematics is not specific to deaf subjects. Boaler et al. (2016) argue that despite certain advances, mathematics is still presented almost exclusively as a numerical and symbolic subject for millions of students, with many missed opportunities for visual understanding. Furthermore, the authors report that students who prefer visual thinking are often labeled as having difficulties in mathematics.

To enhance visuality in mathematics teaching, the *MathLibras* project produces videos under some premises:

> In the context of the *MathLibras* project, video production prioritizes the protagonism of Libras as the main language, highlighting the stance of the deaf actor, who must be central to the viewer. Furthermore, the images and animations explore the concepts involved but do not pollute the screen. Regarding the visual elements, both the images and the linguistic contexts of Libras were negotiated with the team, considering the cultural aspects that would have the potential to produce meanings. In this way, images and animations sought to meet and respect the cultural and linguistic demands of the target audience of the videos, that is, deaf children and adolescents. (Lebedeff & Grützmann, 2021, p. 165)

The analysis of how deaf children received the videos mobilized the project team. Despite the care used in production involving all possible intersections (mathematical language, Libras, and animation), we noticed some mistakes that must be discussed to improve video quality from a linguistic and visual aesthetic point of view.

One of these mistakes was the arrangement of the images in the video. Placing the images as mathematical sentences non-linearly, i.e., portions and results were not in the same line or setting the calculation up with the portions below each other with the result in the following line, eventually prevented understanding and visualization, which we believe generated misinterpretations.

Another factor to consider is signage in Libras. Although the signs are clear and follow the students' age group, the actor could sign more slowly, as not all deaf children are born in homes where Libras is their native language. Of the entire class, only one of the children has Libras as L1. All the others were born in hearing homes and learned Libras at school. For young children, therefore, we believe that the *MathLibras* videos can be an important resource for teachers and families as, in addition to mathematical language, they present short narratives that can expand the vocabulary of children and adults who are acquiring and learning Libras.

The analysis of critical events by Powell and Silva (2015) showed us that the children, without support, solved the challenge independently in the last video, considering the proposed animation was not ideal for additive field sums. The teacher's intervention and explanation on the board in the first two videos were fundamental for the children to understand how to reach the result of the challenge in the third video.

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