Process of Production of Bilingual Didactic Materials of the National Institute of Education for the Deaf[1]

Processo de Produção de Materiais Didáticos Bilíngues do Instituto Nacional de Educação de Surdos

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ABSTRACT: This paper aims to present the various stages of production of bilingual didactic materials of the National Institute of Education for the Deaf (*Instituto Nacional de Educação de Surdos* - INES), analyzed in their theoretical and technical aspects (pre-production, translation and post-production), with a description of the principles of multimedia learning linked to the conception of bilingual digital objects developed at the Online Education Center (*Núcleo de Educação Online* - NEO). Considering the present shortage of bilingual didactic material available for the education of the deaf, we intend to contribute with the establishment of fundamental quality parameters for this kind of production. In this work, we present 15 stages of the workflow for the production of bilingual didactic materials from NEO, among which we highlight the role played by the translators-interpreters team, who take turns in the role of translator-presenter, translator-supervisor and translator-proofreader. In addition, the fundamental principles of multimedia learning in the development of bilingual didactic materials are emphasized. Thus, we concluded that the references of multimedia learning allied to the guiding principles of the education of the deaf creates a line of development of didactic materials possible, with innovation and interdisciplinary methods, to a deepening of knowledge capable of contributing to the qualitative expansion in the production of bilingual didactic materials in Sign Language/Portuguese Language.

KEYWORDS: Bilingualism. Deafness. Translation. Didactic material. Special Education.

RESUMO: o presente artigo tem como objetivo apresentar as diversas etapas de produção de materiais didáticos bilíngues do Instituto Nacional de Educação de Surdos (INES), analisadas em seus aspectos teóricos e técnicos (pré-produção, tradução e pós-produção), com a descrição dos princípios da aprendizagem multimídia vinculados à concepção de objetos digitais bilíngues desenvolvidos no Núcleo de Educação Online (NEO). Tendo em vista a escassez de material didático bilíngue hoje disponível para a educação de surdos, pretende-se contribuir com o estabelecimento de parâmetros de qualidade fundamentais para esse tipo de produção. Neste trabalho, são apresentadas 15 etapas do fluxo de trabalho para produção de materiais didáticos bilíngues do NEO, dentre as quais se destaca o papel da equipe de tradutores-intérpretes, que se revezam nas funções de tradutor-apresentador, tradutor-supervisor e tradutor-revisor. Além disso, são enfatizados os princípios fundamentais da aprendizagem multimídia no que tange ao desenvolvimento de materiais didáticos bilíngues. Dessa forma, conclui-se que as referências da aprendizagem multimídia aliadas aos princípios norteadores da educação de surdos cria uma linha de desenvolvimento de materiais didáticos possível, com inovação e métodos interdisciplinares, a um aprofundamento de conhecimentos capaz de contribuir com a expansão qualitativa na produção de materiais didáticos bilíngues em Libras/Língua Portuguesa.

PALAVRAS-CHAVE: Bilinguismo. Surdez. Tradução. Material Didático. Educação Especial.

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1 Introduction

In recent years, we have witnessed an exponential growth in the offer of bilingual education (Sign Language/Portuguese Language) for deaf students in the country (Lei n. 13.146, 2015). From the officialization of Brazilian Sign Language, in April 2002, through the Federal Law No. 10.436 (2002), public policies have been structured to expand the bilingual modality, ratifying the teaching of Sign Language as the first language, and teaching of the written modality of the Portuguese Language as second language for the deaf. Thus, bilingualism began to be offered in order to complement the common national base, in a 'dialogical, functional and instrumental' perspective (Decreto n. 5.626, 2005).

Despite the outstanding linguistic advance, the use of bilingual didactic materials is still scarce in the country. According to Moraes, Scolari, and Paula (2013), a significant part of the bibliography of technical subjects is developed only in Portuguese Language, and deaf students only rely on the exposition of the interpreted class, without the possibility of reviewing the content and studying from materials produced in Sign Language.

The participation of Sign Language interpreters in the classroom, still small in relation to the demand of deaf students in the country, also results from the lack of adequate didactic materials and bilingual teachers/professors, not putting into effect the inclusion of the deaf student in the academic community. The interpreters, for the most part, do not have the same academic degree as the teacher/professor of the discipline, and end up facing difficulties with the specificities of each subject, since their education does not match the concepts worked by the teacher/professor directly affecting the translation process to Sign Language, with distortions in the understanding of the content by deaf students (Sousa & Silveira, 2011).

This conception of bilingualism ends up dissolving the potentialities of deaf students to develop cognitively through Sign Language. In addition, schools and universities neither have adequate physical infrastructure for this public nor teaching methods based on the specificity of Sign Language and deaf culture (Machado, 2002). In this context, it is possible to perceive that public policies of inclusion, when poorly executed, result in ineffective proposals for deaf education, since they do not allow access to learning through the first language (Sign Language) of these students.

Therefore, this paper aims to present the various stages of production of bilingual didactic materials of the Online Education Center (*Núcleo de Educação Online* - NEO) of the National Institute of Education for the Deaf (*Instituto Nacional de Educação de Surdos* - INES), analyzed in their technical aspects (pre-production, translation and post-production) and theoretical, with the description of the principles of multimedia learning linked to the conception of bilingual digital objects developed at INES.

2 The production of bilingual didactic materials

The concept of teaching material is developed from the type of support that will promote access to a specific content, as the text or video does not exist outside the support material that allow its reading and/or vision (Chartier, 2002). In order to meet the growing demand for bilingual materials, INES, a direct and specific administration body of the Ministry

of Education, National Reference Center in the Area of Deafness, created NEO to promote and accompany the continuous improvement of multimedia didactic materials.

The work developed by NEO seeks to expand the actions of dissemination of knowledge in the field of deafness, as well as Brazilian Sign Language, in light of innovative educational proposals and the integration of new information and communication technologies, aiming at human development and the integration of the deaf community's needs in relation to INES. In this context, several work packages are organized for the construction of bilingual didactic materials with the use of project management methodologies, in order to define tasks, schedule and function in the activities previously selected.

Mainly for serving deaf students and considering visuospatial aspects of Sign Language, the production of didactic materials carried out by NEO is digital, focused on the development of digital learning objects executed by a multidisciplinary team (teachers/professors, educational designers, graphic designers, scriptwriters, translators-interpreters and studio staff). Thus, a collective workflow is structured and divided into three major phases (pre-production, translation, post-production), which is illustrated in Figure 1 below.

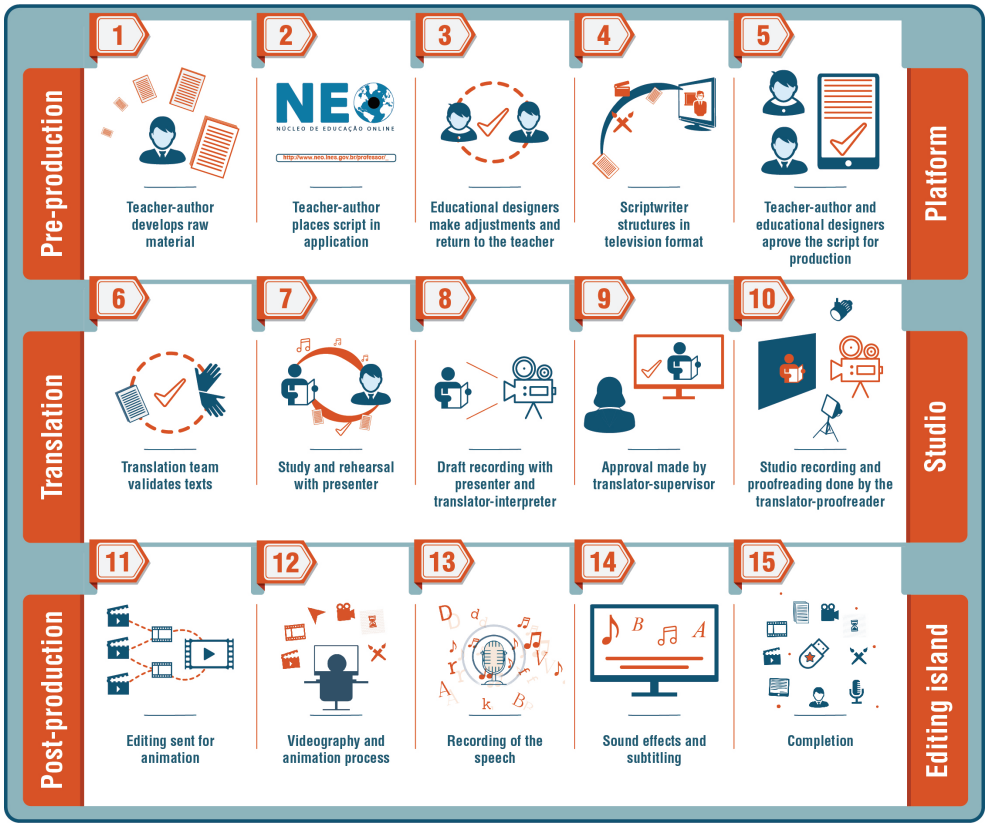

Figure 1. Main steps of the workflow for the production of bilingual didactic materials (Sign/Portuguese Languages)
Source: Elaborated by the authors.

2.1 Pre-production phase

The pre-production phase of the learning objects is divided into 5 stages, and performed on a platform developed by NEO (neo.ines.gov.br/professor). The platform was developed with the purpose of facilitating the production flow of didactic materials, allowing online interaction to those involved in the process.

The first stage in building a bilingual digital learning object is the development of the raw material by the teacher/professor-author (stage 1). When accessing the platform, the teacher/professor is automatically directed to a discipline related to his/her area of activity, where he/she can elaborate a textual script with the main indications of the didactic material that will be built (stage 2). To prepare the script, the teacher/professor has the possibility to consult the teacher/professor's manual, developed to assist the teaching staff in the formulation of didactic material.

All material proposed by the teachers/professors-authors is worked on by educational designers (stage 3), who are part of the multidisciplinary team and are responsible for shaping each discipline according to the needs of the deaf students. The language used in a digital learning object requires the sensitivity of the educational designer to reach the student in a conceptual and entertaining way, making learning an effective multimedia experience within the proposals worked on by the teacher/professor-author.

After the work of the educational designers, the content is sent to the scriptwriter (stage 4), in order to adapt the teacher/professor's proposal to the technical language of recording. The scriptwriter amplifies the indications made by the teacher/professor-author, working on the non-verbal language through visual didactics. As it is a bilingual education with focus on visual and imagery, the completion of the script shows the dialogical and representative capacity of the didactic material, both for the deaf public and for the listeners. Before finishing the pre-production stage, the teacher/professor-author and the educational designer validate the modifications made by the scriptwriter (stage 5).

2.2 Translation phase

The translation process carried out by NEO counts on a fixed team of translators-interpreters, since translation is characterized as a constant and necessary activity for the production of any bilingual learning object. The basic team consists of three translators who work on the language pair Sign Language/Portuguese Language. These professionals take turns, depending on the project, as: translator-presenter, translator-supervisor and translator-proofreader.

The translation, independent of the adopted methods, is essential to obtain satisfactory results in the production of bilingual didactic materials. This work, developed in an integrated team, promotes the quality of the final product to be delivered, according to the quality metrics established by NEO for the education of the deaf.

After the five stages of pre-production, the script of the didactic material developed in Portuguese Language is sent to the translation team. The first moment of analysis is essential for defining the scope of the work. This is an overview of the translation to be performed in which the team verifies the proposal, the goal, the target audience, the style and other factors; as a translator profile, in order to define the scope and duty of each one in the project. Once

the assignments are defined, each interpreter/translator starts to read the material personally. Obviously this is not a common reading, as described by Aubert (1994, p. 26)

> As a Receiver, the translator can be understood at first as one of the recipients of the original message. And indeed, the translator may have been, at some earlier moment of the immediate past, near or remote, just that. In the scope of the translation act, however, this Recipient--Translator will have a different attitude, given as 'common reader'. In this role, his/her reading will be done not only aiming at a reconstitution of the message, whatever its nature, simple or composed (referential and/or poetic and/or conative etc.), but he/she will tend to constitute a first exploration of the linguistic (style, terminology, etc.) and factual problems that the task of translating the text in question will impose on it.

According to the pre-established duty in the project, each member analyzes the source text of the translation under a different point of view. At this moment, the terminological survey is done, including the identification of possible translation problems. Another point to be defined at the beginning of this phase is the type of consultancy: conceptual, vocabulary or both. The conceptual consultancy covers the teacher/professor of the discipline or other professional of the area of knowledge of the requested content, while the vocabulary consultancy is focused on the strategies and search tools available. Especially the translator-presenter, who will appear in the final product, outlines translation predictions that are certainly beyond terminological and meaning concerns, taking into account extralinguistic and aesthetic aspects.

Although common sense stereotypes the work of the translator as solitary, we emphasize that, in fulfilling any demand, the designated translator will use exchanges with peers and other professionals. Figure 2 below shows a cut of the translation stages, exemplifying the workflow developed only in the translation of bilingual didactic materials.

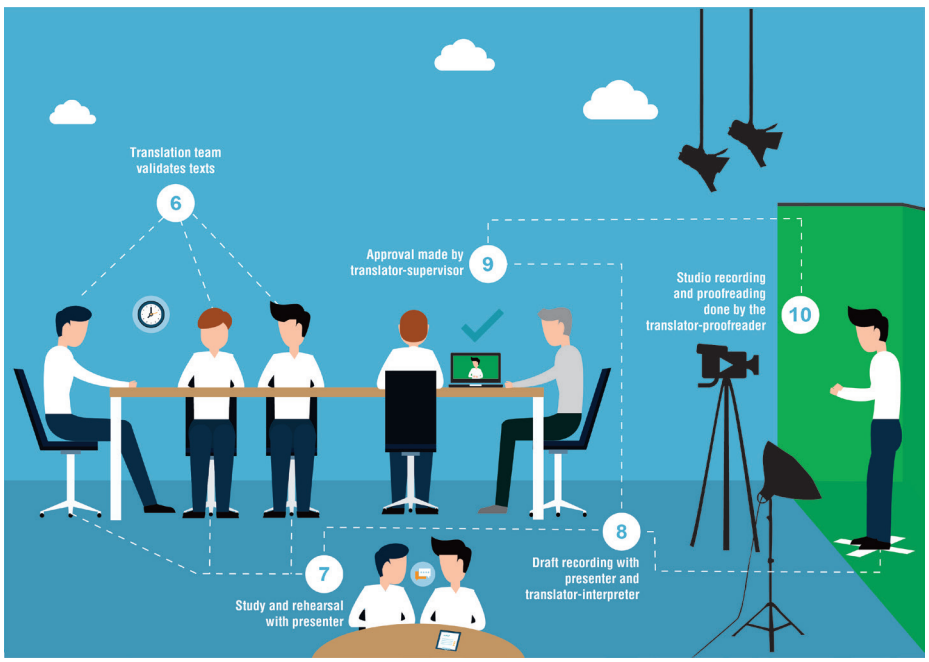

Figure 2. Stages of translation flow of bilingual materials
Source: Elaborated by the authors.

In the work developed by NEO translation team, such resources and procedures are foreseen, which leads us to the validation of the script (stage 6), in which the team meets to discuss the gathering of textual information and predictions previously made individually.

When describing the study stage prior to the translation of the text, Segala (2010, p. 37) presents a correlation between the number of pages and the time of execution: 'This procedure takes about 40 hours, that is, one week to translate a text of approximately 13 pages'. Thus, the prior study is essential, and, if we considered a translation between oral languages, the work would be advanced because the translator would have already made his/her searches and choices, as well as recorded them in the target language. However, in the case of Sign Language translation, several steps beyond the ones mentioned above are necessary.

The next stage (stage 7) is marked by the action of the translator, who will act in the video (translator-presenter), adjusting the text for video-registration. Next, the translator elaborates the text for TP (telePrompter) and structures rehearsals through drafts (stage 8). Depending on the project, the NEO translators adopt '*glosinais*'[7] (Campello & Castro, 2013) for the text to be displayed on the TP, while others make a mapping, in which brief phrases serve as a sketch for excerpts of the text, such as short phrases, in order to remind them of the content of each part of the text. Another common practice is the use of the draft video as a guide. In the case of translators who are listeners, there are still those who prefer to use, in addition to the written text, audio for mapping text or glosses with their own voice for guidance during recording.

If the presenter chooses to make his/her draft on video, the translator-supervisor can assist him/her in this stage (stage 9). Such action aims to minimize the risks of recording again in the future, as well as to align the position of the translator-presenter with the guidelines of the script for the final recording. It should be noted that the type of draft is at the discretion of the translator-presenter, depending on the recording strategy that he/she will adopt in the project.

In the recording process, supervision is also necessary. The obligation of this professional is mainly due to the effect of the modality, because in oral languages the translator is in front of the text he/she is producing at all times. The usual practice of a written language translator allows him/her to briefly re-read the latest sentences, to identify spelling mistakes, redundancy, repetition of terms, etc., as well as to make any adjustments he/she deem necessary. In Sign Language translation this is not possible because the translator is not able to evaluate all aspects of translation at the time of recording; hence the importance of supervision, in order to identify and alert the translator-presenter the need for possible adjustments.

According to Leite and McCleary (2009), when they argue about learning Sign Language, the authors mention the fact that the user of Sign Language does not have feedback of his/her own production while signing. In this sense, the translation practices used by NEO are in agreement with this theory, noting that this factor does not only influence the learning of Sign Language, but also significantly interferes in the translation, which justifies the need for supervision in the filming of texts translated into sign language.

[7] '*Glosinais*', according to Campello and Castro (2013, p. 14), '[...] supports the translation procedure, adding comments, real cases and others. It is performed by a translator who stands behind the camera passing on the information of the Portuguese language written to Brazilian sign language'.

The translator-supervisor's external gaze, in the perspective of 'reader' of the text, is important support because it contributes to the clarity of information, adequate use of space and positioning. This duty also avoids the rework of recording long parts for a potential slip-up made without the attention of the translator-presenter. This stage of supervision is characterized by the joint work of two translators, implying the practice of the supervisor's metadiscursive look at the translator-presenter. According to Polchlopek, Zipser, and Costa (2012, p. 28)

> The translator is seen as a *'critical recipient'* because of his/her ability to m
>
> anage cultural variables and act as a mediator between two codes, which is why he/she is always in conflict between the cultures involved and the recipient, indirectly active during the process of textual production.

After the adjustments and adaptations established by the translator who will present the text in Sign Language, the final recording is performed in the professional studio of the Online Education Center (stage 10), with the support of the translator-supervisor.

To complete the production stage, the translator-proofreader receives the final product. This procedure, like any other text, is done by another person on the team who has not participated in the previous processes. Thus, the third member of the team assumes such duty during the editing of the video. In addition to supporting the editor in organizing the recorded sequences, or the parts where subtitles or other resources will be used, the third member of the translation team is concerned with signaling and other technical aspects.

2.3 Post-production phase

The post-production of bilingual teaching materials takes place on the NEO editing island, with the participation of graphic designers and video editor. After recording the final screenplay, the video editor receives the raw audiovisual material and the recording script for the initial decoupage of the video. Careful visualization of the entire video is the first task performed on the editing island, where the editor detects technical recording errors and makes the first cuts in the material according to the accompanying script (stage 11).

The edited material is forwarded to the team of graphic designers for the process of videography and animation (stage 12). In this stage, static images such as illustrations, photos, diagrams, charts, maps are produced, and also in dynamic form, through the use of videos and animations. Mayer and Moreno (2002) clarify the difference between animations, videos, photos and static images. The animations comprise of a simulated movement of images from the movement of artificially created objects. The videos, in turn, show the movement of real objects. Static graphics are representations of artificial objects, while photographs are static images of real objects. In this process of elaboration of the visual resources, different software packages of graphic design are used, and the video platform and computer graphics are in 3D format.

In the next stage, the recording of the speech (stage 13) takes place, where professional announcers with male or female voices (corresponding to the presenter's gender) are used, recording the audio versions in Portuguese. After the recording of the speech, the track of sound effects adapted to the project is produced as well as Portuguese subtitling (stage 14).

Finally, in the project completion stage (stage 15), the video editor unifies the audio, sound design (speech, sound effects) and synchronizes the subtitles to the video. As they are two different languages, the process of synchronization of Sign Language with the speech and caption in Portuguese must be performed by the video editor with the assistance of a translator-interpreter.

3 Bilingual visual production

When developing bilingual didactic materials, we take into account some principles based on knowledge about how the brain processes information during learning. According to Mayer (1997), one of the most important areas of Cognitive Psychology is the understanding of technology as a tool to promote efficient learning. Currently, there are several researches on multimedia instruction and learning focus on hearing students. However, the studies performed in relation to students who are deaf or hard of hearing are rare.

Through the main theories of cognition, concrete and effective learning occurs through steps or stages. In Figure 3, we can observe how information processing occurs according to Mayer's Cognitive Theory of Multimedia Learning (2005), adapted according to the perspective of the deaf student.

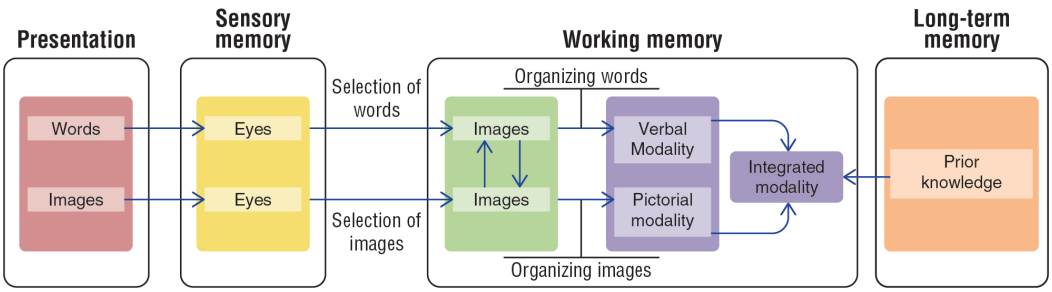

Figure 3. Mayer's (2005) information processing model adapted according to the perspective of the deaf
Source: Elaborated by the authors.

The processing of information starts from the moment the deaf student assimilates images and words from a multimedia presentation, which can be, for example, a video in Sign Language. To capture this presentation, written words and images enter through the eyes of the deaf, and are briefly represented in the sensory memory. Then, in the working memory, the deaf selects the main words and images and organizes them, categorizing written words in a verbal model, and images in a pictorial model. From this organization an integrated model of information is structured. This integrated model is directly linked to the long-term memory, where the student can activate pre-existing knowledge to be integrated with verbal and pictorial models in the working memory, storing the resulting knowledge in the long-term memory.

4 Evidence-based principles in multimedia learning

The cognitive model proposed by Mayer (2005) describes some fundamental principles behind multimedia learning, defined from his theory and based on the evidences that are essential for the elaboration of bilingual materials:

1) Multimedia principle - *Words and images are better than words alone.*

This principle proposes the combined use of images and words, as it allows the brain to process more information in the working memory (Paas & Sweller, 2014). Thus, people learn better with words and images than words alone. In this context, words include written and spoken text, and images include videos, animations, and static graphics.

In the education of deaf people, which uses Sign Language as a means of communication, images are essential for understanding academic concepts and, when words are used as well, they help students in the learning process. Due to the visual gestural characteristic, Sign Language can be presented along with the Portuguese Language, respecting the phrasal structure of each one of these languages, composing two informational processing channels necessary for bilingual education.

Similarly, in the didactic materials developed by NEO, we present simultaneity between the presentation of Sign Language and characters. This simultaneity enables deaf students to have a variety of integrated learning styles, broadening their understanding of the content worked. In the same way, we seek to ensure that the speech is synchronized with what is happening in the video (characters) and the Sign Language itself. The interaction between image and caption constitutes student-oriented meaning, proposing the textual interpretation of the video and its occurrences. We can observe this problem in face-to-face teaching, where deaf students need to maintain attention in the visual presentation of the teacher/professor and, later, receive the explanation from the interpreter. When we use digital bilingual didactic materials, we strengthen the compatibility of the readings, establishing singular dynamics in the learning process. The application of the concept in the development of bilingual teaching materials also privileges the hearing, since the signaling in Sign Language appears to the students synchronized with the caption and speech in Portuguese Language within the scope of the statement, respecting the syntactic and grammatical structures of each language.

2) Principle of spatial contiguity - *Words should appear close to images.*

This principle includes spatiality as a didactic element to the learning of deaf students. Animation, as a figuration of reality, ratifies the meaning that the text wishes to pass. From the point of view of bilingual education, the use of images close to words forms a mechanism of interface between the two languages (Sign Language/Portuguese Language) possible, as they are part of the linguistic daily life of the deaf and the hearing. Considering the spatiality of Sign Language, written words should be part of the discourse of the deaf presenter, since there is spatial interference between the written register of the Portuguese Language and the movements of the Sign Language. Thus, a truly bilingual learning object is structured, with the integration of the two languages into the same statement.

3) Segmentation principle - *Contents must be presented by parts*.

This principle states that people learn best when a multimedia lesson is presented in segments of the user's rhythm instead of a continuous unit. In this context, digital learning objects of NEO are developed at various levels of theoretical depth, so that the student may learn through videos with segmented content. In this process of knowledge construction, we use a visual didactics capable of composing meanings through animations, that is, while the presenter explains the concept in Sign Language, the animation presents the concept in development (segmented illustration), facilitating the appropriation of the content by deaf students.

4) Principle of divided attention - *Multimedia learning is most effective when the student's attention is not divided.*

Several researches have revealed that a deviation of attention leads to an excessive use of the student's working memory, thus reducing the effectiveness of the learning process. Deaf individuals have more 'developed' peripheral vision than hearing people, but more information in the peripheral vision of the deaf may distract them, impairing attention (Dye, Hauser, & Bavelier, 2008). In this sense, the bilingual didactic materials are developed on a screen with a monochrome background, in order to focus the student's gaze on the presenter and the animations.

5) Assumption of limited capacity - *The presentation of multimedia content should exclude irrelevant and redundant information.*

According to Mayer (2003), multimedia learning is most effective when only relevant content is presented in the animation. Redundant or irrelevant information must be eliminated to avoid overloading the working memory. The working memory has limited capacity for processing and storing information on each channel. Reaching this capacity, learning would be blocked. Also according to this theory, there would be three categories of cognitive load: (1) the intrinsic, which represents the volume and complexity of the information to be processed; (2) the relevant, which is imposed by learning activities that benefit learning; and (3) irrelevant, which does not contribute to learning, but wastes mental resources with excessive and irrelevant information (Merriënboer & Ayres, 2005).

From this principle, we established a maximum number of words for each bilingual didactic material (600 words), since this amount is equivalent to the production of a 5 minute video in Sign Language. The word limitator in the scripts has been shown to be efficient, encouraging teachers/professors-authors in the construction of concise and pragmatic scripts, regardless of the degree of complexity of the material.

5 Conclusion

The process of building bilingual didactic materials, which is based on a diverse set of tasks, requires the structuring of a multidisciplinary team capable of developing pedagogical (teachers/professors), linguistic (translators-interpreters) and techniques (filmmaking, graphic design and editing).

In relation to the proposed work, it is possible to affirm that the complexity of the development of bilingual content and the metrics of quality established by the Online Education Center significantly influence all 15 stages of the process, changing the variables of time, cost and quality of didactic materials. As we consider Sign Language as the main communication channel, we use deaf and/or bilingual presenters in all didactic materials, placing Sign Language on the first language level.

Although the pre-production is mainly developed in Portuguese Language by the hearing teachers/professors-authors, it is the translation phase that establishes the basic parameters of the material, since the correlation between Portuguese Language and Sign Language is stipulated adopting the premise of a visual production in Sign Language, with about 5 minutes of signage for each word of text in Portuguese. This way, teachers/professors who use Portuguese Language produce scripts suitable for the production in Sign Language, considering the other stages of development. From this process, it is possible to indicate aspects about the recording time of the video, which should be limited to three hours, because with physical and mental fatigue, errors and interruptions become more frequent, in addition to this, posture and facial/body expressions of the translator-presenter deteriorate.

In the translation phase, methodological and practical aspects permeate all team activities, which does not exclude the theoretical approach. Differently from what is observed in other theoretical tendencies, especially the traditional ones, the translation worked on by NEO does not understand the role of the translator as a mechanical activity, since this professional must be understood as a questioner, not passive or unconscious before the information that he/she receives. In this context, the translator assumes the role of critical receiver, because in front of a text he/she should question its functions and pedagogical objectives, considering for whom the text will be translated (deaf public), among other variants. Thus, the didactic materials with better acceptance by the deaf public show that the translator must abandon the lexical literalism in defense of a contextualization of translation, adequate in both the language and the culture of arrival.

In order to make bilingual material congruent, the post-production phase seeks to integrate the spatiality of Sign Language with written words, generating a third informational channel, characterized by illustrations and animations developed by graphic designers. These elements allow the configuration of an integrated bilingual didactic material (video, text, speech, animation and subtitling).

In this way, we conclude that the references of multimedia learning combined with the guiding principles of the education of the deaf create a line of development of didactic materials possible, with innovation and interdisciplinary methods, to a deepening of knowledge capable of contributing to the qualitative expansion in the production of didactic bilingual materials in Sign Language/Portuguese Language.

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