A Usage-Based and Neurocognitive Approach to the Learning of English as a Foreign Language With Deaf and Hard of Hearing Students: A Case Study

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This paper presents a section of the thesis: Teaching English as a foreign language to deaf and hard of hearing children included in regular education in the city of San Juan, Argentina. This is an exploratory-descriptive research based on a case study. The subjects are students with a hearing loss ranging from moderate to severe. The instruments used are school documents (students tests, lesson planning, etc.), records obtained from non-participant observation, and interviews. Data were analyzed using ATLAS-ti software. This work is based on the theoretical assumptions of neurocognitive linguistics, and the theory of usage-based acquisition. In this presentation, we analyze the written productions of four deaf and hard of hearing students learning EFL in regular schools. One of the main contributions of this research is that making use of cognitive-based theories could be beneficial to EFL teaching to deaf and hard of hearing students.

Keywords: deaf, hard-of-hearing, EFL, foreign language, neurocognitive linguistics, usage-based

Introduction

This paper presents a section of the thesis: Teaching English as a foreign language to deaf and hard of hearing children included in regular education in the city of San Juan, Argentina. The objectives of this research are: the description of the current state of teaching English as a foreign language (EFL) to deaf and hard of hearing students enrolled in regular schools, to determine levels of achievement of these students, and to identify strategies to optimize this task. This is an exploratory-descriptive research based on a case study. The subjects studied in the thesis are students with a hearing loss ranging from moderate to severe. The instruments used are school documents (students tests, lesson planning, etc.), records obtained from non-participant observation and interviews. Data were analyzed using ATLAS-ti software. This work is based on the theoretical assumptions of neurocognitive linguistics (Lamb, 1999) and the theory of usage-based acquisition (Tomasello, 2000).

Some Concepts Taken From Neurocognitive Linguistics

The brain is part of the central nervous system, one of several systems that together make up the body. The

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cerebral hemispheres are of great importance for language. It is believed that the two hemispheres, right and left, are interrelated to puberty and thence begin to lose plasticity; that is what advocates of the critical period hypothesis hold (Nunan, 1999). Research made by Lenneberg (1967) in children and adults who had experienced a brain injury, indicated that the damage to the left hemisphere was quickly repaired in the case of children but not in adults (Ellis, 2012, p. 24). There is no clear consensus on when the completion of this critical period would be, but Singleton (2005), who reviewed the literature on the subject, claims that can end in late adolescence. He also added that there is a consensus that the end point comes earlier to pronunciation than to grammar (Ellis, 2012). It is believed that the right hemisphere, which is considered the most creative, is related to art, space, color, rhythm, and musical imagination, among other artistic activities; on the other hand, the left hemisphere is mostly linked to language, to logical operations, numbers, sequencing, and analysis (Fisher, 2005).

In the early 1960s, the French neurosurgeon Paul Broca discovered, after examinations in dead patients, a fact that led to establishing the existence of a language dedicated area on the back of the lobe front of this hemisphere, now called Broca (Dubuc, 2003 en Alho 2010). For his part, later, Dr. Carl Wernicke, German neurologist, found that one of his patients who could speak, could not understand the speech of others and determined to have an injury in the left temporal lobe, an area known since then as Wernicke's area (see Figure 1). These findings were confirmed in numerous studies in other patients and "such findings in the areas of Broca and Wernicke, today are generally confirmed by modern neuroimaging studies" (Lamb, 2011, p. 535).

Figure 1. Areas involved in language processing in the brain (Dubuc 2003 en Alho 2010).

A recent discovery has detected that Wernicke's area, part of the human brain that processes speech, is not located in the section where previous medical science findings supported. Thanks to neuroscientist professor Josef Rauschecker, lead author of research in this area, it was revealed that Wernicke's area is located three inches closer to the front of the brain, in front of the auditory cortex, not behind it, as verified by a scientific study in the Medical Center in Georgetown University in Washington. As stated in the journal *Proceedings of the National Academy of Sciences of the United States of America*, more than 100 MRIs (Magnetic Resonance Imaging) demonstrated this novelty, which should be incorporated as a significant change in medical literature.

Between the areas of Broca and Wernicke, we find the arcuate fasciculus, which has a significant amount of fibers and, according to Seldon (1985, in Lamb, 2011), it is considered the most extensive sensory area for language from the physical point of view and more visible in microscopic terms (see Figure 2).

Figure 2. Wernicke's area, Broca's area, and the arcuate fasciculus (Lamb, 1999, p. 368).

The theory of relational networks emphasizes the fact that there is high connectivity of all the subsystems in the brain. This connectivity can be seen in the different fibers and fiber bundles that make up the white matter and that are under the cortex. "The white matter consists of fibers and fiber bundles—together with their insulation, made of myelin—which provide interconnections among different parts of the cortex and subcortical structures" (Lamb, 1999, p. 305). This can be seen in Figure 3.

Figure 3. Some long-distance fiber bundles (Lamb, 1999, p. 305).

A basic concept in this theory is the neuron (see Figure 4), which is basic in the wiring of connections; a cortical neuron cell receives input through its dendrites and directly into the body of the cell, and sends output by the axon and its branches. One of the main features neurons have is that they have excitatory connections to other neurons, and inhibitory connections to other neurons; the points at which a neuron is connected to another are called synapses.

Figure 4. A typical cortical neuron (Lamb, 1999, p. 310).

For neurocognitive linguistics, the linguistic system is linked to other subsystems of the total human cognition; and the mind is seen as a system of networks characterized by its connectivity. This cognitive system interprets external symbols resulting from a process of selective activation of neural connections. The activation of these connections strengthens the links between them, thus consolidating the network. Knowing a language, is knowing how to use it, which implies being able to perform certain processes, which, in the framework of the theory of relational networks in neurocognitive linguistics it means firstly, movements of activation of network connection between node and node, and secondly different operations that alter the shape of the network. These alterations may result either in strengthening connections, or in constructing inhibitory connections; the former causes the strengthening of structures, while the latter results in the weakening of the links between nodes, thus originating defective or erroneous constructions. The language and the system of networks change when in use. The movement of activation of the network can take several paths, some of which are detailed in Figure 5.

Figure 5. Some cognitive subsystems and their interconnections (Lamb, 1999, p. 183).

This diagram allows us to see activation paths in various directions: The upward direction through the network is directed towards meaning, and the downward direction, towards expression. The level of auditory perception is located at the bottom of the reception area, and the level of phonetic articulation at the bottom of the production level. The linguistic processing has two directions: production and comprehension. Production means that activation proceeds from the perceptual and/or conceptual areas to the area that controls the operation of the articulators; while in reception, activation proceeds from the auditory system through linguistic connections to the conceptual and/or perceptual and/or motor areas. Planning and the processes indicated in Figure 5 are considered a high organizational level. There are several possibilities for activation of the different subsystems shown in Figure 5.

The *proximity* principle indicates that connections can recruit upcoming subsystems to integrate a combination of properties of an adjacent subsystem (Lamb, 1999). The proximity hypothesis, together with the plasticity of the brain, makes us suppose that there are no discrete boundaries between the different subsystems, as well as considering the different experiences people could have had in childhood. It can also be noted that when more time and interest are devoted to a function that corresponds to a subsystem, this function is then increased, which leads to another principle: *abundance*. This principle implies that “latent connections have no predetermined functions, but take their roles experiencing the system” (Lamb, 2011, p. 551). The *proximity* hypothesis makes us suppose that different areas are plausible of making any association of meaning with sounds or images. This, in the case of deaf or hard of hearing students is of utmost importance.

We can summarize some of the main assumptions of neurocognitive linguistics according to Lamb (1999) as follows: A linguistic system is related to other subsystems of the total human cognition; the mind is a system of networks whose information is in its “connectivity”; the cognitive system does not have a place to store symbols or interpret or generate rules, but rather, it is a system that interprets symbols that come from outside and that occur there. In this context, learning is seen as a process of selective activation of neural connections. It is estimated that a linguistic system can change at any time, especially when in use, and that these changes are given by the strength of the link. What is more, this theory argues that both the linguistic and the conceptual systems are

different from one speaker to another. An important principle in this theory is that there are no symbols in the network model; for Lamb, the “memory” is the network. In this approach, the linguistic system has a large internal complexity; it is a complex of multiple systems (Silva, 2000; Lamb, 1999).

This is also related to the hypothesis of subsystems raised by Paradis (2004), which holds that “a distinct linguistic system of other cognitive systems is recognized but connected with them, both to receive sensory input and to send activation to the articulatory and digital-manual systems” (García, 2012, p. 155). This hypothesis explains how the bilingual system works; according to this theory, components and representations of L1 and L2 are autonomous networks from a neurofunctional point of view, yet they are fully represented within this global linguistic system, which consists of a subnet of neural connections for each microanatomic language, which can be activated or inhibited separately in each language and between both languages, because of the interconnectedness of the subsystems (García, 2012).

Usage-Based Model

“In usage-based models of language—for example, those of Langacker (1987, 1988, 2000), Bybee (1985, 1995), and Croft (2000)—all things flow from the actual usage events in which people communicate linguistically with one another” (Tomasello, 2000, in Geeraerts, 2006, p. 439). Usage based models claim that children learn a language from actual utterances, i.e., of particular utterances in particular contexts, and build linguistic representations from these utterances, each more complex and abstract. Children begin to understand a sentence when they begin to understand the intentional actions of others as well as their communicative actions. Language is seen as a “cultural artifact” (Lee, Mikesell, Joaquin, Mates, & Schumann, 2009, p. 68), that is, as a complex adaptive system that emerges from the verbal interaction and, therefore, does not require innate linguistic representations formulated a priori. It is argued, therefore, the existence of an “interactional instinct” in humans that drives them to interact with others, which in turn allows you to record frequencies and discover recurrent patterns (Müller, 2012).

The psycholinguistic unit of analysis used in this model is the utterance (Tomasello, 2000), understood as “a linguistic act in which one person expresses towards another, within a single intonation contour, a relatively coherent communicative intention in a communicative context” (Tomasello, 2000, in Geeraerts, 2006, p. 440). “A communicative intention is when two people share the same intention and direct their attention to a third entity (Tomasello, 1998a)” (Tomasello, 2000, in Geeraerts, 2006, p. 440). This theory assumes that language is global and that language acquisition is the result of interaction.

Tomasello (Lieven & Tomasello, 2008) argues that grammar emerges from the analysis of real “usage events” and that some environmental factors that influence it are the *frequency*, *consistency*, and *complexity* of structures. The more frequently a morpheme, word, or construction is heard, the earlier it is acquired. Experimental studies have shown that the frequencies of forms and constructions can interact to produce learning outcomes. There are two kinds of frequency: token and type frequency; the former refers to the comprehension and use of particular items and phrases in concrete pieces of language, i.e., collocations; the latter refers to the frequency with which different actual forms occur in the same slot (for instance verbs in the past participles marked with -ed in the past tense). This promotes generalization by demonstrating to the learner that within the context of “the same” construction, different concrete items may serve the same function. So the difference

between token and type frequency is between entrenching¹ specific words or phrases and creating slots in which a range of words or phrases can occur. *Consistency* promotes learning, whereas *complexity* impedes it. *Consistency* refers to form-function mappings; it is related to the consolidation and automatization of the relationship between the form and meaning of linguistic representations. *Consistency* can operate on several levels: phonological form of syntactic structures or semantic function. Finally, *complexity* can be determined by different factors, for example, the location of words, the relationship between a syntactic constructions already known, and learning a new one (Lieven & Tomasello, 2008).

Analysis of Written Productions

The students involved in this study had a hearing loss ranging from moderate to severe and were included in regular classes learning English as a second language in the year 2011.

The analysis will focus on the correlation between the language students were exposed to, and the written productions they produced at the end of a teaching unit. We correlate the frequency, consistency, and complexity of the structures to which students were exposed for each teaching unit, with productions that were written at the end of the unit.

The four cases analyzed are shown in Table 1:

Table 1

Deaf and Hard of Hearing Students Included in ELT Classes

Case	Diagnosis	Course	Weekly timetable	Studied the L2 since	School	Teacher qualification	Aid
1	Hard of hearing moderate loss (60db)	5th grade	2 modules of 80 minutes	1st grade	Confessional, upper middle class	Teacher of ESL, university degree	Hearing aid
2	Deaf, deep loss, recently implanted	3rd year	2 modules of 80 minutes	1st year	Confessional, middle class	Training in English at a tertiary level	Sign language interpreter (SLI)
3	Deaf, deep loss, recently implanted	4th grade	2 modules of 80 minutes	4th grade	Confessional, middle class	Lawyer, training in English from a private institution	Sign language interpreter (SLI)
4	Hard of hearing, moderate loss (60db)	5th year	3 periods of 40 minutes	1st grade	Secular, attended by students of professional families	Teacher of ESL, university degree	Hearing aid

Case 1

The declarative contents students were exposed to during 13 class periods were: expressing likes and dislikes, and actions related to the routine using the Simple Present tense in first and third person in the affirmative, negative, and interrogative forms. When analyzing the student's assessment at the end of the teaching unit, we found an exercise at sentence level (Exercise 1), and two at text level (Exercises 3 and 4). In Exercise 1, the task was to write sentences about what Angelo's friend likes and does not like, we can notice that

¹ Constructions are ways of saying things and the frequency of all or parts of constructions that children hear or say results in their entrenchment, that is in their representational strength which, in turn, makes them increasingly available for the processing and production of utterances. Constructions can be entrenched at varying levels of specificity and schematicity.

this student used the correct form of *verb + ing* to express actions after verbs *hate* and *like*, but with a spelling mistake in two of them. These aspects of negation and lack of control of spelling denote that the linguistic representations used by the student are still under construction. Also, we noticed that in the four sentences the student inserts the verb *is* before *like*, *likes*, or *hates*, and even before the negation, which is a typical mistake of a system under construction. This may be because they might have been exposed to sentences with the verb *to be* many more times than to sentences with 3rd person singular in simple present, resulting in the strengthening of a nexion that in turn strengthens the entrenchment of this construction.

In the first task at textual level (Exercise 2) the student is asked to write, first a paragraph about the routine of a person using adverbs of frequency, with visual support, and the percentages that prompt which adverb of frequency should be used, and further requests about the use of connectors, that is writing in a controlled manner; in the second paragraph the student is asked to write about her own routine prompts are also given. In this case students have choice of what vocabulary and structures to use when they refer to the activities they perform in their daily lives. In both productions (Exercises 2 and 3), the student meets the requested task and evidences a correct sentence structure, as well as successful vocabulary use and use of adverbs of frequency and connectors; however, in the first text we can see that the student has not yet acquired the morpheme *-s/-es* for the third person singular of verbs in Simple Present. The second production (Exercise 3) is in first person, so this morphological problem is not present. However, in some cases there is absence of the subject.

If we analyze these productions following a usage-based approach, they show that the grammatical constructions used by the student are very close to a strengthening. This has a correlation with the type of frequency of the language the student was exposed to. In this sense, we notice several aspects that favored the type of frequency. First, the teacher used an inductive approach to teaching grammar nine times throughout the unit, which involved making several questions until students reached conclusions; also, twice other peers were involved in giving support, and only once they were given a direct grammatical explanation, all these instances were made through questions using the target language all the time. Secondly, with regard to the rubrics, the teacher acted as mediator² five times, and once she gave the instruction directly, always in English. Thirdly, as regards correction of errors, the strategies used by the teacher also facilitate the strengthening of structures to learn: she reformulates,³ repeats what was said by the student on five occasions, and she also uses recasts.⁴ Another instance of the frequency with which the student is exposed to the target structure is related to the questioning strategy used by the teacher; for example, every time she made personal questions, before asking the question to the hard of hearing student, she questioned several students (between seven to five), using the same grammatical structure and different lexical set, in the same slot. Most of the teaching strategies were based on a cognitive approach; this can be seen on inductive⁵ work done by the teacher for grammar explanations and use of questions for understanding. According to Lamb (1999), “the use questions has the cognitive function of inviting

² It refers to “the part played by other significant people in the learners’ lives, who enhance their learning by selecting and shaping the learning experiences presented to them..., this involves helping learners to move into and through the next layer of knowledge or understanding” (Williams & Burden, 1997, p. 40).

³ The teacher says the correct form of what was said incorrectly by the student.

⁴ Technique used in language teaching to keep communication going, may be using a gesture or repeating what was said using a rising intonation.

⁵ An inductive activity is the one in which students are asked to infer the rule or make generalizations out of examples (Larsen-Freeman, 2014; Celce Murcia, 2014, p. 268).

you to find a location in the cognitive network” (p. 203), which in turn is beneficial for building structures, to comply with the principle of linking text with pre-existing knowledge of the student. Another instance of exposure is the review to the test (Pre-Test) in which students do similar exercises to those they have to do in the Written Test. The recurrence of these constructions can help strengthen the connections that lead to strengthening these mental representations.

With regard to consistency, it is noted that at the semantic level the relationship between form and function of the structures present in the input is consistent, as the Simple Present is always used to express routine and no other function. We can also associate at this point the visual aids used at different levels, which benefits the form-function mapping. The teacher made use of visual media on seventeen occasions: to support explanations, oral work, on the board, taking advantage of iconic material from the book, reference material brought as extra material, drawings, etc. At the same time, we can highlight the use of visual support in the Pre-Test exercise, which, according to Lamb (1999) favors the construction of semiotic structure on the basis of information from other subsystems, such as visual, apart from the linguistic one.

On the other hand, from the point of view of the complexity of the structures of this unit, the command of the language in the productions of the student makes us suppose that grammatical constructions showed no greater complexity.

Case 2

In the second case, the declarative contents developed in the teaching unit were: five lessons devoted to teaching the use of modal verbs, and the following seven classes to expressing actions relating to the past, making the contrast between the Past Simple and Past Perfect. As for the productions of this student, it was interesting to see that there was no assessment for these contents. Of the materials analyzed, the productions found in the student’s notebook were related to modal verbs, nothing concerning the use of past tenses. These productions consisted of two exercises at sentence level (Exercises 2 and 3) and two at text level, one concerning comprehension and completing with one word (Exercise 1), and the other, production of a text.

The first exercise at sentence level is related to the ordering of words to make grammatically correct sentences, and the other, correct the error in each sentence. The student got nine correct sentences out of 16. The main problems in sentence construction had to do with auxiliary subject inversion or lack of auxiliaries. In the first exercise at text level, the student had to complete a dialogue with modal verbs; he got six right out of eight.

In the last writing task the student had to write a text about obligations using modal verbs seen in the unit, the student made mistakes such as lack of subject in sentences, wrong choice of words—lexis taken from the dictionary, but not suitable for context, wrong use of modal verbs and verbs, chopped sentences, and lack of connectors that indicate lack of cohesion and coherence. The teacher made all the corrections and the student wrote the correct version under the previous one.

It is interesting to see that in the exercise at sentence level in which the student produces a more controlled production, he demonstrates a better handling of the structures taught, while in a less structured production the student makes many mistakes and cannot use the new language effectively, and neither is he able to communicate successfully.

We can say that these productions may have a correlation with the kind of exercises carried out during this unit. For this student, who has a deep hearing loss, the type of frequency she was exposed to depended largely on the interpretation done by the SLI and on reading comprehension; in this sense the students performed tasks such as joining sentences, writing and completing sentences, either in a slot or completing a sentence. This shows a structuralist approach to language. Although students performed comprehension exercises and four times, and the teacher activated prior knowledge, this was done in Spanish. Much of the exposure to the language and most of the interaction between the teacher and students was conducted in Spanish, the rubrics were generally given by the teacher in Spanish, as well as the grammar explanations, which were interpreted by the SLI; the teacher explained grammar 17 times explicitly on the board, she used translation, and worked at sentence level. Judging by the production of the student, it is noticeable that the type of frequency which the student was exposed to was more favorable for sentence completion exercises and slots in a text, than for the production of a complete text. Although at semantic level the relationship between form and function of the structures in the input is consistent—each modal verb is used to express a single function, consistency is not very favorable at text level. Visual support was not enough to reinforce form-function consistency, it occurred only five times: Once visual support was given on the board, once in the book and three times when the SLI followed with her finger in the book and notebook lines when the instructions for the various activities were read.

The student produced grammatical constructions without much difficulty at sentence level, while at textual level, we can notice some complexity. If we consider that “at the semological levels, the processing of the interpreter involves both, recognition and structure building” (Lamb, 1999, p. 198), we can conclude that for this student connections between links may not have been strong enough to recognize and reinforce the way in which structures were built. This has a correlation with the quality of the language to which the student was exposed.

Case 3

In the third case, the declarative contents addressed are the verb “to be”, possessive adjectives “my” “his” “her”, the conjunction “and”, prepositions of place “on”, “in”, “under”, “behind”, and imperatives “run”, “jump” and “catch”; vocabulary: pets, colors, adjectives, verbs; functions: understanding descriptions of animals, asking and answering about animals and where they are, asking and answering about possessions, understanding and giving simple instructions. The procedural contents refer to showing understanding of information by matching, completing, circling, colouring, completing, etc.

In the evaluation the exercises were: Exercise 1: Read sentences and circle the correct picture. Example: The ball is in the box. Exercise 2: Complete sentences (given a pictorial prompt—prepositions and vocabulary items are evaluated), for e.g., This is my ____ (rabbit) _____. ____ (Her) ____ name's ____ (Cloe). The third exercise is to look and circle the correct word (“his” or “her”), referring to a drawing of a boy and girl with their belongings. For e.g.: His/Her fish is small. In the next exercise students had to read, draw and colour; animals and colours are evaluated; in the next exercise students are asked to look at a picture and circle the correct answer to the question given. For e.g.: Is it big? Yes, it is./No, it is not. In the exercise that follows students should recognize the appropriate action depicted in a drawing by circling it. And in the last exercise they have to complete two sentences with personal information. For e.g.: My pet is a _____. The second and final productions require completion at word level; they all have visual support and the full evaluation covers the contents seen in

this unit. The student had 100% success in his responses, although he had spelling difficulties in two words: instead of “rabbit” and “turtle” wrote “robbit” and “Trute”. In the exercises at production level, the student had to complete slots and is noticeable that the student identified the kind of word that was in every space: verb, noun, or animal.

If we analyze the results of the evaluation relating them to the frequency type of language that the student was exposed to, we can say that the student is able to recognize linguistic representations, place the words properly at sentence level, and fill slots in sentences competently, this is in keep with the kind of language the student has been exposed to.

As this student is characterized by a deep hearing loss, the exposure to the language during the teaching unit depended largely on the interpretation done by the SLI and on reading comprehension. When we analyzed the frequency type of language to which he was exposed, we observed that most of class work done by the student is in the Activity Book, where he performed the complete work, activities included: circling words, word recognition with visual support, drawing, completing sentences with a word, colouring, circling the differences, listing, marking with a tick or a cross, counting and completing sentences (is/are), matching, counting, looking at the picture and completing words, among others. This type of work was matched with the type of activities used in the evaluation of this unit. All exercises were at sentence level and mostly at receptive level, i.e., understanding and showing comprehension of sentences through some task of selecting either a picture or a word or short answer.

During classes, the teacher explains grammar explicitly six times. This demonstrates a structuralist approach to language, based on sentence level and word level. In classes the teacher used the technique of listening 10 times, but mostly for repeating structures, whether in a song (chant) or repetition of vocabulary or what was said on the CD. These techniques reinforce the structuralist and behaviourist approach to foreign language teaching. Besides, the teacher asks students to spell words to almost all students in eight opportunities, even the deaf student. Other techniques used in the classroom to reinforce learning were: copying on the board and copying from it, repeating after the teacher several times, and answering when being asked after several students were asked. Most of the time the teacher speaks Spanish, this happens in 52 opportunities, and 18 times she mixes Spanish and English. As regards error correction, the teacher carried out comprehension checks four times, she reformulated what the student said, corrected his notebook, and modelled language. The only instance of work following a cognitive approach is when the teacher activates prior knowledge before an activity, which was done on three occasions; however, this was conducted in Spanish.

This leads us to note that in the semantic level the relationship between form and function of the structures present in the input is consistent. The structures exhibit a consolidation that could be attributed to the strength of neural connections. Visual support reinforces form-function consistency, this occurred most of the time both during class work and in the evaluation. The SLI gave visual support pointing the lines in the book and notebook at the same time the teacher read the instructions for the different activities. Considering the proximity principle, this makes us suppose that different areas are plausible of making any association of meaning with sounds or images, allowing connections to recruit adjacent subsystems to integrate a combination of properties of the different subsystems (Lamb, 2011). Regarding the complexity of the structures, no major problem is noticed, since most of the time work was done at sentence level and keeping the number of spaces.

In this learner we can conclude that the level of language processing showed a strengthening of the structures, mainly at the level of word recognition and sentence structures; manifested mainly in the completion of parts in a sentence with a lexical item; we suggest that due to the quality of the language to which this student was exposed—most of the time in Spanish, and English on rare occasions, the connections between links may not have been strong enough to the strengthen pathways that favor the production of sentences or text; connections were only activated for recognition at lexical and sentence level, not production, so a consolidation is seen only at these levels.

Case 4

The fourth case is a student who attends 5th year of secondary school, who has studied English as part of the curriculum from kindergarten. The main theme developed in this teaching unit was the use of Conditionals type I and II, understanding and expressing situations that may happen in the future using the first conditional and of hypothetical situations. The assessment consists of four exercises, the first is a reading comprehension exercise in which the student has to choose the correct answer, which the student performs correctly (see Figure 6):

Figure 6. Case 4: Reading exercise, situation 1.

This first exercise also displays two situations for which the student has to provide the answer. In both cases, although the student shows some difficulty expressing the whole sentence, the sentence structure is generally correct, following the order of an affirmative sentence: subject + verb + complement, and the meaning is also appropriate. Difficulty is evidenced when he has to add a clause with the conjunction “and” (see Figure 7):

Figure 7. Case 4: Reading exercise, situation 3.

In the second exercise the student is asked to rewrite four sentences using the connector “unless”, although the exercise is focused on structure, the student needs to understand the logic of the statement to do it correctly. All the sentences that the student produced using this connector were correct.

In the third exercise the student was asked real personal questions to be answered using the first conditional. Although there is no evidence of great difficulties in understanding and use of conditionals type I and II in the whole test so far, in the last exercise of the test the student did not write anything. We do not know if it was because of lack of time or he just decided not to do it. It is noticeable that this student does not have curricular adaptations, and probably he may need to have some more time to complete all the tasks in this test.

Now we correlate this evaluation with the language to which the student was exposed during the classes in which these contents were developed. The first point to note is that the language used by the teacher most of the time is English, and occasionally mixing English and Spanish. Rubrics are given in English most of the time and she works inductively with students. This makes the amount of input that the student receives abundant. In terms of quality of input, if we analyze exposure to the target structure—conditionals type I and II, we can see that there is a high frequency of comprehension and production activities. The situations students are exposed to are related to real life and what students actually do in these circumstances, this is done through the completion of written or oral sentences. The teacher also resorts to activation of prior knowledge. The teacher uses other strategies that favor the frequency of exposure to language, she questions several other students before asking the hard of hearing student, she also reformulates or involves another student to give support and to offer explanations.

Although most of the student's productions are at sentence level, it is noticeable that the strategies used by the teacher are based on a more cognitive approach, namely activation of prior knowledge, mediation of rubrics and inductive work. Furthermore, there was consistency between form and function of the structures taught in classes and the evaluation, since conditionals were used to respond to situations like those seen in class. However, the student might have had some problems regarding the complexity regarding the structure of a complex sentence: When two clauses were joined by "and"; this was shown in the evaluation when the student evidenced some difficulties when they had to produce sentences with this conjunction, showing a lack of consolidation in this sense.

Correlating the work done by the teacher in class and the student production in the assessment, we notice that the frequency with which he was exposed to the contents and the consistency with which he worked with these contents may have contributed to the student's activation of neural networks enabling him to achieve a strengthening of the structures taught.

Discussion

We have analyzed the productions of four deaf and hard of hearing students learning English as a foreign language included in regular schools. The study was based on the analysis of written productions of these students from the perspective of neurocognitive linguistics and relational networks (Lamb, 1999). Although we cannot make generalizations or comparisons, given the fact that this is a case study, observations allow us to arrive at certain conclusions that could be useful for deaf and hard of hearing students.

We can notice some correlation between, on the one hand, a more inductive style in teaching following a cognitive approach, with the aid of other subsystems apart from the linguistic, namely, the visual one (especially in Case 1) and a strengthening of the structures used by students demonstrated in most appropriate use of the language, which can be seen in Cases 1 and 5; and secondly, some correlation between a more behaviourist/structuralist style, with little exposure to the language—language at word or sentence level—and a

more fragmented and poor language performance, as seen in Case 2.

In Case 3, language processing was mostly carried out by means of repetition and recognition of sentence-level structures, both in the language to which the student was exposed in class and in the evaluation, being a beginner in learning the foreign language, this may be a suitable approach to get accuracy in the responses.

Conclusion

Since this is a case study, we cannot make generalizations, however, we can point out the importance of relating the frequency, consistency, and complexity of the target language to which deaf and hard of hearing students were exposed to, with the teaching strategies followed in each particular case. This correlation makes us acknowledge the benefits of using a cognitive approach, which could be seen in the productions of the students analysed in this study

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