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Communicability in Corporate Intranet: Analyzing the Interaction among Deaf Bilingual Users

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***Abstract*— This article presents issues of communicability that can impact in the interaction of pre-linguistic bilingual deep deaf user on a corporate Intranet. Therefore, an evaluation was carried out in the interface of a corporate system of a science and technology institution in health based on the Communicability Evaluation Method (CEM) from the Semiotic Engineering, where the objective was to evaluate the failure in communication between the interface and those users. From this research, which analyzed failures in communication between the interface and deaf users in an organizational context, it was possible to demonstrate the importance of including deaf users in the development process of interfaces for corporate information systems on the web by reducing the existing gap between these users and the interface.**

1. Introduction

Usability, an important feature of information systems, does not guarantee full access to all users [18, 25]. It is necessary that systems are also geared towards accessibility [16, 21, 26].

Some users, for example, pre-linguistic deaf, those who became deaf before learning how to speak and have no hearing memories, they have not mastered the Portuguese language, and may encounter difficulties in performing simple tasks, due to the predominance of textual information on the Internet [27]. In this case, it is necessary that the content is translated into sign language, in the case of Brazil, the Libras (Brazilian Sign Language).

As in Brazil, there are roughly 5.7 million Brazilians having hearing impairment, accounting for 3.38% of the population [10], it is crucial to recognize the specificities of the interaction of these users with information systems in order to minimize barriers that may compromise or prevent the use of the corporate Information Systems (IS) on the Internet.

Translating the contents into sign language by using videos with interpreters, although more appropriate, pushes the cost up for implementing, maintaining and storing the contents making it difficult for any project [7].

This research aims to evaluate the communicability between a corporate intranet interface and deaf users, in order to observe their interactions with systems and thus to get to know this profile of people seeking a better communication of interfaces.

For this purpose, we made observations of users interacting with the Intranet of a science and technology institution of in health, which has an agreement with the National Federation of the Deaf Education and Integration (FENEIS), which it employs some 150 deaf workers [13]. The evaluations followed the Communicability Evaluation Method (CEM) from the Semiotic Engineering (EngSem), which seeks to maximize the developer's knowledge, as regards the users' difficulties based on the results of the metacommunication analysis [8, 9].

2. Deafness and Web Accessibility

A. Deafness

Deaf people are characterized by hearing loss between seventy and ninety decibels and above ninety decibels. This fact generally affects the verbal comprehension of these individuals by creating difficulties in acquiring oral language naturally. [30] Another factor that impacts the acquisition of oral language is the evolutionary period of hearing loss, characterized in two forms: pre-and post-linguistic acquisition. The pre-linguistic deafness is characteristic of people who were born deaf or who lost hearing in childhood, before acquiring speech, not having hearing memories. As for the post-linguistic deafness is that for people who lost hearing after language development [30].

The deaf have the speech organs equal to that of non-deaf people and they do not develop the speech properly because of the absence of the hearing, they have difficulty in pronouncing consonants and often rendering the speech intelligible [31]. Suffice to illustrate this, it is as if a non-deaf person had to learn an unknown language only through lip-reading. Deaf who communicate orally and do lip-reading are deemed oralized [23].

For the Brazilian deaf, the meaning process of words comes from the translation of sign language, a natural language for the deaf, for the written Portuguese language [1, 17]. This limits reading and interpreting of deaf users, since large part of the vocabulary of the Portuguese language does not exist in sign language, making it difficult to interact with this group of Internet users [6, 22, 27]

Libras, Brazilian Sign Language, does not include a structure based on articles, prepositions and conjunctions, as it has verb conjugation different from Portuguese. The concept of "word" or "lexical item" in Portuguese, when in Libras, is referred to as signal, and it consists of the combination of five parameters: setting, movement, direction, articulation point of the hand, and facial expression.

In this language, most verbs are expressed in the infinitive form. There are inflections of gender and number in nouns and adjectives, and the notion of time is marked by time adverbs indicating whether the action is happening in the present, as now ands today, it occurred in the past, like yesterday and the day before, or this will occur in the future, like tomorrow. As in Libras there is no gender distinction as there is in Portuguese, when its textual representation is required, you must use the @ symbol to reinforce this idea. For example: a sentence written in Libras: "Question: I INVITE YOU TO COME ME@ HOME. YOU CAN D-A-Y? Answer: NEXT SATURDAY, I CAN" [12]. This example illustrates, even if briefly, the differences between Libras and written language.

Libras does not have its own system of writing, i.e. deaf individuals should use the written form of the Portuguese language in conducting the activities of reading and writing [20]. It makes use of the manual alphabet to represent words in Portuguese which do not exist in Libras, such as people's names and locations. In theses, the deaf read the word which should be spelled by word [12,17].

Interpreting and building meaning for written information is not a simple process due to the specific linguistic complexities of each language [11]. In the case of the deaf this situation worsens due to the inadequate teaching strategies for reading in school times, which minimize the access to the text information in Portuguese, and to the difficulties in incorporating the specific cultural issues of Portuguese [11,13].

These linguistic limitations compromise the intellectual skills of the deaf and the cognitive development, but they do not change their intellectual potential, which is considered to be normal [14,24]. However, their challenge, besides using the oral language, is to overcome the learning difficulties so that they can interact in a non-deaf society by playing their social role [14].

The language used by a community has a more wide-ranging responsibility than only communicating among the individuals. This contributes for the transformation of social, cultural relationships and experiences, which are the basis for building cultures and identity [10].

The existence of "deaf culture" has been considered in works such as by Mouro [4], which advocates its existence. Underpinned in the multiculturalism concept and not only in ethnicity, nation or nationality, that culture differs from others because of its linguistic aspect, where the social and cultural relations are impacted due to the necessity of using sign language as a communication tool [32, 17].

As the deaf people live in an environment where most people is oralized and communicates through speech, they often do not identify themselves with this environment, which hinders their social interaction, and can make them feel isolated and socially excluded at times within their own home environment [12].

Research carried out by Felipe and Dalcin show that deaf children of hearing parents, accounting for approximately 95% of cases, feel like foreigners in their family relationship [34]. However, taking part in environments of deaf culture enables these individuals to experience a sense of inclusion, belonging, and familiarity [12]. The fact that the participants in the deaf community are recognized by the signal itself, assigned by another deaf person, and not by their first name, given by their family,corroborates the statement above [34]. "The personal signal is the name itself, the 'Given name' of a person who is a member of the Deaf community" [12].

Deaf people struggle to have their civil rights respected, because their culture has linguistic aspects, way of life and learning, values, behaviors, their own social and interactive traditions [12]. As an example, the recognition by the Brazilian legislation of Brazilian Sign Language (Libras) as a legal means of expression and communication, possessing a linguistic system with its own grammatical structure, more than replaces the modality of writing of the Portuguese language [3].

B. Accessibility

The Web plays a critical role in the advance that the Internet represents in the daily life of people with limitations such as blindness, deafness, cerebral palsy, and others. This has totally changed the lives of these users because it provided them with freedom never before imagined. [15]. It is therefore crucial to recognize the differences of individuals in order to offer the means of accessing any content available on the web [5].

On the Web environment, the most used features as assistive technologies for deaf aimed at removing barriers to access to information. In general, these resources are targeted to the audio content available and are presented through the use of subtitles or transcript of all audio content. The problem is that not all deaf are fluent in Portuguese. For deaf people who have difficulty in interpreting the Portuguese language or communicate only using Libras, it is necessary to use subtitles in Libras of audio content [15].

However, usually technological resources are not mentioned, those which help navigating the Internet of pre-linguistic deaf bilingual on pages where most information is presented in texts. Thus, "the autonomy of the Deaf is limited, and it is necessary to resort to the assistance of others when interpreting the text into LIBRAS and the dictionary for the meaning of unknown words, which can generate even more doubts and frustrations" [6]. Thus, one should understand the different levels of deafness and its specificities, the deaf culture and linguistic structure of this user's profile in order not to standardize deafness as only the lack of hearing.

C. Related Works

Some works already carried out show evidence of linguistic difficulties of pre-linguistic deaf bilingual. About this, Goldfeld approaches the difficulties in understanding Portuguese due to the meaning process of words [17]. Kozlowski's research reinforces that sign language does not have its own system of writing, and deaf individuals should use the written form of the Portuguese language for reading and writing as a second language. [20]

Regarding works that point out the difficulties of the deaf user's in interacting on the Web, Corradi's study reinforces the inclusive participation of pre-linguistic bilingual deaf in the Information Society from planning information architecture in digital environments [6]. From this perspective, Abreu presents a set of recommendations of accessibility to Information Technology and Communications projects that enable literacy of deaf children [1]. A study conducted by Oliveira pointed out the Communicability Evaluation Method (CEM) as one of the most efficient methods for evaluating accessibility for deaf users [27].

This article presents communicability issues impacting user's interaction who are deep pre-linguistic bilingual deaf on a Corporate Intranet. Thus, it is expected to contribute to the development of this more accessible system to these users' profile, seeking its inclusion in the organizational environment.

3. Evaluating Interfaces on the Semiotic Engineering Perspective

To guide designers in developing accessible systems there are recommendations and guidelines with guidance on how the accessible systems should be designed. In the case of existing systems, it is necessary that the interfaces have their accessibility checked. For this purpose, programs have been developed to evaluate, automatically, the level of accessibility of the systems [15].

But the process of accessibility of system not only provides an interface that validates automatically, it also requires a validation which is done with humans, both with the participation of experts and users with limitations. When engaging the user in the process, it becomes possible to observe, analyze their problems and abilities, enabling the alignment of usability requirements with accessibility guidelines, resulting in a harmonious interaction and ensuring understandable and navigable content [15].

Evaluating interfaces is a systematic process of data collection in order to examine how to use a system to perform tasks [29], and to allow the detection of disruption in communication systems. Among the evaluation methods that involve users, there are some which are based on Semiotic Engineering (EngSem), for example, CEM, used in this study [8, 9].

Semiotic Engineering (EngSem) is a theory of Human-Computer Interaction (HCI) that designates to system developers (designers) and users the same role: the interlocutors in a global communication process [8].

This communication is unilateral, since this comes from the designer to the user through the devices present in the interface. During the interaction process with the system, these devices send different messages encoded in various forms, such as words, graphics, images, help messages and all other signs, including various communication codes that constitute a system interface. It is the designers' role to consistently inform users the meaning of each device created and used by them in the interface so that users can understand and answer the messages conveyed by these devices [8].

Communicability Evaluation Method (CEM)

For Semiotic Engineering, the human-computer interaction is characterized as a specific case of metacommunication, where the designer communicates with the user through the system (interface) to tell them how, and why they and what for they (should and can) communicate with the system so as to achieve their goals [8, 9].

CEM is a method where the experts in EngSem analyze the reception of the message sent to the users by the designers in order to evaluate the communication and identify potential failures or disruptions. The failures (disruptions) of communication occur when users cannot interpret the message sent by the designer, whether in performing a particular action or answering the system after some action, which may or may not be perceived by users. The complete failures occur when users do not understand the message. The partial failures occur when users can understand only part of the message. As for the temporary failures occur when at first users do not understand the message, but later they realize the intent of the message and try to perform the action correctly.

CEM is performed sequentially in three main phases: tagging, interpretation and creating semiotic profile, all three carried out after preparing and observing (tests) stages of interactions with users. Although the preparing and observing (tests) stages of the interactions are common to other methods with users' participation, for using CEM, they are needed to carry out some specific procedures: During preparation, the evaluator must conduct an inspection of tasks described in the test scenario in order to instantiate the general scheme of metacommunication. The result of this inspection will serve as a comparison to the last instance of metacommunication reconstructed from the evidence observed during the users' interaction with the systems and application of the CEM. Observing (test) interactions with the users should be performed by two evaluators and involves the substages: conducting pre-test interview, observing interaction of at least two evaluators, recording the interaction between users and conducting post-test interview. The information collected and produced in these phases serve as a source of reference during CEM application by assisting evaluators in interpreting the evidence [2, 8, 9, 28].

TABLE 1.
TAGS, MEANINGS AND COMMUNICATION FAILURES - ADAPTED FROM [8 P.138].

Tag	The user's behavior demonstrates that he ...	Category
"I give up."	**didn't care about the outcome.**	Complete failures
"Looks fine to me."	didn't realize he/she had failed and completed the task as he/she saw fit	
"Thanks, but no, thanks."	**understood the designer's solution, but preferred to interact in another way**	Partial failures
"I can do otherwise."	**did not understand the designer's solution and preferred to interact in another way**	
"Where is it?"	**knows what has to be done, but is not able to find out how**	Temporary failures
"What happened?"	did not realize or understand what the interface was telling him/her	
"What now?"	**doesn't know what to do at the moment**	
"Where am I?"	**performs an action that does not fit the context**	
"Oops!"	realized he/she performed a wrong operation and redoes the operation correctly	
"I can´t do it this way"	**after a long interaction, realizes he/she took the wrong path**	
"What´s this?"	**tried to understand the interface element through tips displayed on same**	
"Help!"	**resorted to help systems or asks for help from other persons**	
"Why doesn´t it?"	**Tried to understand what went wrong and repeated the operation**	

Source: data collection

In the first stage of evaluation, tagging, evaluators analyzed the pieces of evidence of disruptions in communication, through the videos of interactions, associating the problem from the set of thirteen possible expressions of communicability (tags) proposed by CEM, these labels represent the evaluator's interpretation of how the user behaved in relation to the interaction context. Table 1 shows the complete set of the thirteen possible expressions of communicability (tags). Tags should be classified according to the types of communication failure: complete failure, partial failure, and temporary failure. [8, 9, 28].In the second stage, the interpretation is based on mapping and tabulating expressions of communicability, in this phase the evaluators can explore important aspects of metacommunication that can be summarized in the following guiding questions: (1) What is the frequency of tags for participant, for test scenario, for interface element or any other criteria considered relevant? (2) What are the patterns of occurrence of the tags in the context of the activities of each participant individually or in the context of all participants to the same activity? (3) Can the types and sequences of labels be associated with problems in establishing the goals and subgoals of communication? [28-33].

Finally, the third stage, creating semiotic profile, the analysis process is concluded with a characterization of the receipt of metacommunication messages, which is the interpretation of the data identified in the previous stage, seeking to rebuild the metamessage that the designer wants to convey through the interface seeking to maximize the developer's knowledge as regards the user's difficulties, based on the results of the metaanalysis [8, 9, 28].

4. Methodology

This research, of exploratory nature, was based on the qualitative method of data collection, and is composed of three stages: (A) Preparing the test environment, (B) observing users´ interaction, (C) analyzing the results through the CEM.

As the study participants were bilingual deaf people, during various stages the participation of two Libras interpreters were needed for receiving the participants, translating the consent form, testing scenario, conducting the interviews and during the observations.

Observing and evaluating the communicability is performed by two beginner evaluators in using CEM. The synergy between the experiences and expertise of the evaluators, one with experience in usability and accessibility and another, with extensive knowledge of deaf culture and information architecture, which is also a Libras interpreter, enabled to identify the disruptions in the communicability of user's interaction with the system.

As for the second volunteer interpreter, who helped to conduct the research but was not involved in the ratings, was selected to work in Feneis and has a professional experience, with four years of work devoted to the

deaf-oriented social assistance.

Users participating, with the appropriate profiles to the study, were invited during an interview for FENEIS occurred in the science and technology institution in health. We chose to invite users with the following characteristics were chosen: deep pre-linguistic deaf, bilingual literacy, having Libras as the first language and Portuguese as a second, frequency of computer use more than three years and education level from elementary school (in order to make homogeneous the knowledge of the Portuguese language). It is important to clarify that the users had never performed the tasks in the system proposed in the scenario, once usually the CEM is performed with tasks which bring some kind of challenge or novelty to the user.

The sample consisted of eight individuals. In order to ensure the anonymity of participants, they are encoded as U-1, U-2, U-3, U-4, U-5, U-6, U-7, and U-8.

The option for the analysis of the Intranet of the science and technology institution in health was due to the fact the institution employs about 150 deaf workers, enabling great source of human resources for developing the research.

One sought to determine, through informal interviews with industry professionals in human resources, activities commonly performed by the professionals of the institution in the research environment. The scenario was developed so that users carried out the actions sequentially, enabling the identification of flaws in the interpretation of the information from the system. The first task defined was filling out a form to update personal data, which consisted of filling out 46 fields for data entry, the figure 1 shows some of these fields.

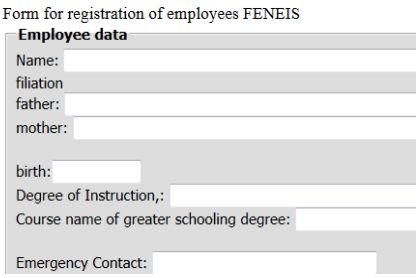

Fig. 1 - Example of fields on the form.

The second task corresponded to the opening of a call to technical support staff informing problems in the mouse. In this activity, users should navigate the Intranet until they reach the page for a support request. Table 2 shows the shortest route to be traveled by users to complete call to the technical support team.

In order to verify problems in testing and formulating the scenario tasks, a pilot test was carried out in the morning and with that participant there was no need for changes in the test and scenario environment. Time limit for testing was not stipulated as it respected the interaction time of each individual user.

Observing users´ interaction

During this stage, the interpreter presented the research objectives and explained the procedures for its implementation. The content of the test scenario and the consent term were translated into Libras to be read and signed later. Testing occurred in the Library of Public Health of the science and technology institution in health, in a controlled environment, created specifically for the research. This choice was due to the ease of movement of research participants, since all work in the institution.

TABLE 2

TABLE WITH THE SHORTEST ROUTE TO BE TRAVELED BY USERS.

	Steps for navigation
1.	Access the Intranet page.
2.	Log in with CPF (The Roll Of Individual Taxpayers In The Ministry Of Finance) and password
3.	Select the job unit to which the professional is institutionally related
4.	On the left side menu, select option “Support and Systems”.
5.	On the submenu, select option “IT Support”.
6.	In the new window, click on “New Request”.
7.	Select option “Replace Mouse and/or Keyboard” from option “Type of Request”.
8.	In field "Description" type in that something is wrong with the mouse.
9.	Click on “Send”.

Two interviews were conducted. The pre-test interview aimed to collect information about the users’ experience in using computers and Internet access, the post-test interview sought to clarify doubts that could influence the tagging and elucidate the general impressions of the participant on the system.

An interview with the deaf consists of four stages: the interpreter reads the questions of the questionnaire that are in Portuguese; the interpreter translates questions into Libras; the user answers the questions of interviews, conducted in Libras; the interpreter translate into Portuguese and writes the answers of the deaf.

The whole process was supported by professionals in the science and technology institution in health and Feneis directly or indirectly involved in the research.

Recording in video of the facial expressions and gestures enabled to identify difficulties in interacting by helping at the stage of interpreting data.

After comments from users, the focus moved to the CEM application, whose stages are below.

Analyzing the Results Through the CEM

Tagging: This stage consisted in analyzing 206 minutes of video of the interactions of the eight users, in order to identify failures in interface communication and relate them to the set of thirteen possible expressions of

TABLE 3.
TAGGING TASK FOR SUPPORT REQUEST

Source	Failure Type	U-1	U-2	U-3	U-4	U-5	U-6	U-7	U-8	Tag Frequency
I give up!	Complete	1	1	1	1	1	1		1	7
I can do otherwise.	Partial		2	2						4
What happened?	Temporary	1	1	2	1		1			6
Where is it?		2		4	3	4	4		2	19
What now?	3							2	5	
Oops!		1								1
Help!	2	3	4	3		3	1	2	18	
Why doesn't it work?			1							1

Source: data collection

communicability (tags) proposed by the CEM. Carrying out both tasks lasted on average 27 minutes per user, except for user U-7, which conducted activities in thirteen minutes and was the only one who could successfully complete the task for requesting support. All other users have given up on completing this task.

In the task of requesting support, the first element used by the participant U-2 was the search option by typing the phrase "technical support". Since there was no understanding as regard the search result, the user repeated the operation, being awarded the tag *"Why doesn't it work?"*. In the second attempt when identifying the same result, the participant requested assistance from the evaluator, being awarded the stage *"Help!"*. After some frustrated actions in trying to accomplish the task correctly, behavior identified on the tag "*Where is it?,"* the user gave up the task, being awarded the stage *"I give up!*."

Still in this task, the participant U-3 was the one that most explored the interface in an attempt to complete the task correctly. This attitude made this participant become more susceptible to allocation of different types of tags, with fourteen tags of communicability the end. As an example, the frequent use of the tag *"Where?"*. The participant began the task of request support selecting the words "technical support" on the sheet of test scenario by searching subsequently for these words in the interface, aiming to achieve the completion of the task through representative words. However, these words were not present at the first level of the main menu interface, consisting only in the second level, causing the user to focus on a number of disruptions, assigned by the tag *"Where?"*. After locating the sentence, U-3 failed to complete the task as he did not know the other words.

The user that most requested aid for explanations of unknown words to the evaluator was U-6, even though he or she knows that the answers could not be provided.

In the post-test interview the participant reported that she had several doubts about the meaning of words, feeling the need to aid in the conceptualization of words. Participant U-4 also reported in the post-test interview he or she felt a lot of difficulty in performing the tasks due to the unfamiliarity of most part of the words used in the interface.

Participant U-7 was the only one who could do the task of requesting support, also presenting less difficulty in performing the task of updating the personal data. In the post-test interview, that user reported difficulties in his or her first interaction with the system as he does not know a few words, but that of the next time his or her interaction would be facilitated by having memorized the way to go to accomplish the task of support request. With susceptible relation to difficulty in understanding the words, the participant also reported that the verbs in Portuguese are very difficult and he or she has difficulties, asks for help of a non-deaf friend or searches for the meaning of the word on the Internet.

Table 3 provides the frequency of the tags present in the take for support request, as well as the total tags per user. During the tagging stage, there was no users' behavior that led to the assignment of tags: *"What's that?," "Where am I?," "Look fine to me", "I can do otherwise," "No Thanks,"* proposed by the CEM methods, therefore these were not presented in Table 3.

In the task of updating the personal data, when analyzing the interaction of the participant U-1 while filling out the field "Degree of deafness," it was realized through his or her gestures, which he or she sought to infer the meaning of the word "Degree," associating it to the word "Pregnancy." As a result, he or she inferred question "Degree of deafness" as: "Are you deaf from birth?". Doubting the reasoning performed, he or she asked for the help of the interpreter. For these disruptions, two tags were associated: *"This way isn't possible"* and *"Help!"* which could only be allocated from the combination of interaction recording and facial expressions and gestures of the participant.

This same participant U-1 conducted a more detailed search in the interface in order to locate resources that helped him or her in accomplishing the task. This action was seen in the movement of the user when putting his or her fingers on the computer screen, trying to contextualize the information contained in the areas of personal data,

TABLE 4 –
TAGS PRESENT IN THE TASK OF UPDATING THE PERSONAL DATA WITH THE USE OF MEDIATION DIALOGUES.

Tag/Users	Failure Type	U-1	U-2	U-3	U-4	U-5	U-6	U-7	U-8	Tag Frequency
Looks fine to me.	Complete	1	2		4	1	1	2		11
I give up!				1	1	1	1			4
No, thanks.	Partial	2	1		2	1				6
Help!	Temporary	2	1	1						4
What is this?								1	1	2

Source: data collection

professional data, etc., delimited in the interface by rectangles.

Still in this task, participant U-2 also carried out a detailed search in the interface. As an example, this user as he or she does not know the sentence "the issuing agency of ID", he or she examined his or her ID and answered the question with the information: "Male", and it is assigned the tag *"Looks fine to me"* to this type of behavior. In fact, the user did not realize the flaw, completing the task incorrectly. This behavior was common in most users during the task of updating the personal data.

Another example on the Tag "*Looks fine to me*" occurred in completing the field "In charge of the area," where two-thirds of the participants answered the unit name in which they work, as they did not the word "In charge."

With respect to the five questions about leisure in the task of updating the personal data: "What do you like to do during your vacation?"; "Do you play any kind of sport?"; "Do you do any other cultural, family activity?" "I would like to know other matters," "Do you have any suggestions for the social project?". Only the participant U-7 answered all questions correctly. Of other users, the only participant U-2 and U-4 answered the question "What do you like to do during your vacation?" correctly. However, they both answered at the second attempt as at first they understood that the question was referring to the month in which they liked to go on vacation. After rereading and reflection, they erased the wrong answer, including the correct one. The other participants did not understand the questions, as they did not answer the five questions of the Leisure topic.

The user U-5 had difficulty in identifying the context of the word "address" by asking the evaluator for some help questioning whether such a word referring to the course location or his or her residence.

Due to lack of some words in Libras, the names of the data entry fields stood out as they showed more complete communication failure: Degree of Instruction, Technician in, Course name of greater schooling degree, Emergency Contact, Libras Knowledge, Oralized, Date of admission, Workstation, Workstation description, Area of Expertise, Workday, Dependents_Name, Dependents_Kinship, Dependents_Dateof birth, Do you have any suggestions for the Social Project?, I would like to meet other matters?, Do you do any cultural, family activity? Do you do any kind of sport?, What do you like to do during your vacation?.

Another common question among users was when the same word occurred more than once on the page, as if the word "name," present both in the area relating to personal data and to dependent data.

In post-test interviews, it was found that users are aware that they do not know a large number of words present in the interface, but even so, they sought through associations, to infer the meaning of words they did not know, resulting in erroneous answers.

Table 4, presents in a consolidated manner, the frequency of the tags present in the tasks of updating the personal data with the use of mediation dialogues. During the tagging stage, there was no users' behavior that led to the assignment of tags: ***"I can do otherwise," "What now?," "This way it is not possible," "Why doesn't' it work?," "What happened?," "Where am I?," "Oops!," "Where is it?".*** Thus, they were not presented in Table 4.

Interpretation: In this stage, the problems of objectivity and its origins were identified. The task of updating the personal data had as more fequent tags *"Help!,"* with 54 occurrences categorized as temporary failures, *"I give up!,"* with 45 occurrences and "Look fines to me," with 34 occurrences, categorized as complete failures, accounting for 51% of cases, respectively.

The temporary failures pointed questions concerning the bilingual deaf users' difficulties in dealing with words that are not in the vocabulary of their first language. The tag *"Help!"* is used when the user explicitly asks for help, as occurred with all participants. As they did not obtain answers when help was requested, most participants left the entry field in blank, being awarded the tag "I give up" or they tried to infer the meaning of the question, believing erroneously they have completed the task successfully, this behavior is assigned the stage *"Looks fine to me."*

In the post-test interviews relevant aspects were identified, such as the difficulty in identifying the context change of information: Two thirds of the users filled out using their own name, two fields containing the same information but distinct functions. One of them referred to the name of the interviewee, the other, the name of their dependent. Another aspect noticed was the habit of the users to ask the meaning of unknown words to a non-deaf person in the absence of that, seeking assistance on the Internet.

When they were asked about their ability to understand

the Portuguese language, only the participant U-3 replied that he or she understood "a little." The remaining participants reported that they understood "partially," always emphasizing that there are many unknown words.

The task of support request evaluated the use and functionality of the system, with the tag *"I give up!"* as the most prominent, with seven occurrences. This is classified in the category of complete failures, pointing questions concerning the interpretation of language expressions of the interface. While browsing, before they gave up, there was a higher incidence of the tag *"Where is it?,"* then the tag *"Help!,"* respectively with nineteen and eighteen occurrences, classified as temporary failures, which together account for 60% of occurrences. The data indicate that in some moments it was not possible to find the element needed to complete the task satisfactorily due to the incompatibility of semantic definitions used. The post-test interviews indicated a desire to refer explanations in their first language due to the amount of unknown words in Portuguese.

Creating a semiotic profile: The metamessage of the organizational system: *"In my interpretation, you are an employee user of corporate system of the science and technology institution in health who has experience in interacting with computers and is fluent in Portuguese. Therefore, this is the system I designed for you. I understand that you would like to use the Intranet to solve specific problems like computer technical support in a practical and fast way."*

Evaluation Results: As a conclusion, the deaf - even with experience in the use of computers, Internet, instant messaging to communicate using video, email and social networks - find difficulties in understanding the linguistic terms present in the interface of organizational systems that prevent them from performing simple tasks.

Terms commonly used in the organizational environment are unknown to the deaf, as "in charge of the area" or "workday", hindering the interaction for the participants. Besides the language issue, there were also difficulties related to the correct identification of the context of information within the interface.

In addition to the language issue, there were also difficulties related to the correct identification of the context of information within the interface.

The questions relating to leisure activities demonstrated the difficulty of the deaf in interpreting sentences in Portuguese. Despite having three participants answered questions correctly, only one understood the question right away. The remaining individuals did not understand the questions and left the it blank.

The completion of the task of technical support request focusing on navigation, recorded the highest number of giving ups, where only one participant reached the conclusion of the task correctly. This task contained large amounts of textual information, making it difficult the correct choice of topics by users, where only one participant reached the conclusion of the task correctly.

The post-test interviews indicated that the participants would like to be able to consult in their first language explanations on filling out the fields, since the number of unknown words in Portuguese hinders them form interacting with the information system. All participants experienced difficulties in interacting with the elements available in the interface.

5. Challenges Identified in Research: Creative Alternatives for Communication Designer Deaf Users

As the Portuguese language provided in text it is potentially generating disruption to the pre-linguistic deaf and videos often create difficulties in implementing it, a possible alternative to approach disruptions found in the study would be adopting new communicative strategies that respect the linguistic specificities of that user's profile, without excluding other possible users' profiles. Among the possible options there is the Web Navigation Helper (WNH) a Web browsing assistant that allows you to perform tasks for users with special needs previously created through dialogues that mediate the user's interaction with the interface [24]. The WNH is implemented ass an extension to the Mozilla's Firefox browser, and the tasks are previously automated by CoScripter, macro recorder developed by IBM [24]. Once "*The WNH behaves as an interpreter not only of the page with which is associated, but of all navigation through it. The end user, a priori, only interacts with the previously created dialogues, 'saving up' any problems on the page, whether they are of usability, navigation, communication, or accessibility, etc."[24].*

6. Final Considerations

The study aimed to elucidate relevant aspects of the interaction of deaf users in corporate information systems on the web. The active participation of this public in corporate environments implies the need for detailed studies that recognize the specific interaction of this group, in order to identify possible barriers that may hinder or impede them from using corporate information systems on the Web.

An evaluation was carried out in the interface of a corporate system of the science and technology institution in health based on the Communicability Evaluation Method (CEM) from the Semiotic Engineering, which objective was to evaluate the failures in communication between the interface and users. Eight users were observed performing two tasks. From the characterization of metamessage, it was noticed that the project did not follow a development oriented to the accessibility for pre-linguistic deaf. Since even the deaf with experience in the use of computers and Internet experience difficulties in understanding the linguistic terms present within the interface of corporate information systems on the Web, which prevent them from performing simple tasks.

The participants also reported that they would like to obtain resources that facilitate the identification of the context of the words, thus facilitating the correct inference

therefrom.

Despite the research method does not provide for video recording of users during the interaction, this was performed by proving to be efficient in the analysis stage. This feature enabled the identification, through facial expressions and gestures used, of doubts during the interaction.

From this research, which analyzed disruptions in communication between the interface and deaf users in an organizational context, it was possible to demonstrate the importance of including deaf users in the development process of interfaces for corporate information systems on the web by reducing the existing gap between these users and the interface.

For further studies it is suggested creating protocols for analysis of web accessibility as it assists researchers in conducting tests of accessibility, given the variety of factors that directly influence search results, among which the most significant is the cultural difference between researchers, participants and professionals who work with deaf interpreters.

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