

TAC-ACCESS - Technologies to Support Communication from Interfaces Accessible and Multimodal for People with Disabilities and Diversity: Context-Centered Design of Usage

Cristiani de Oliveira Dias¹, Liliana Maria Passerino¹, Carlos de Castro Lozano², and Enrique García Salcines²

¹ Universidade Federal do Rio Grande do Sul, Brazil
{cristianideoliveiradias, lpasserino}@gmail.com

² Universidad de Córdoba, Spain
carlosdecastrolozano@gmail.com, egsalcines@uco.es

Abstract. The school and the family can use technological resources to provide the individual with disabilities the opportunity to obtain a good quality of life, autonomy and cognitive development. It is known that the process of inclusion of this subject in the school may not be enough to meet your needs. In both activities both in school and family, using digital services to more intensive monitoring may be a proposal to include homeschooling (Passerino, de Castro, 2013). It was thought therefore, a computing platform that assists subjects, family and school to participate in these scenarios, integrating them. A partnership between one University in Brazil and one University in Spain allow this integration. The research plans to join the Alternative Communication (AC) named SCALA and an operating system and platform in the cloud whose main goal is to give conditions for development to people who are dependent (elderly, disabled) Siesta Cloud software. This integration has aimed at creating opportunities for these people to obtain autonomy, communicative interaction and improvement in their quality of life. For this platform reach the largest number of people, it was necessary to choose the method of usability and we chose for Context-Centered Design of Usage and in this article the process that led to this choice are shown.

Keywords: Usability, Alternative Communication, Context-Centered Design of Usage.

1 Introduction

According to the United Nation Enable (2014) approximately 15% of the world population, 1 billion people, have some type of disability. Policies were necessary to get the equalization of rights and opportunities before and subtracted at the 1994 World Conference on Special Education with the presence of more than 80 governments signed the Declaration of Salamanca in Spain. Important for inclusion and access of

the society resources. The school such as the families can use technological resources that provide the individual with disabilities the opportunity to obtain a good quality of life, autonomy and cognitive development. It is known that the process of inclusion of this children in the school may not be enough to meet your needs. In both activities in school and family, using digital services to more intensive monitoring may be a proposal to include homeschooling (home and school) (Passerino, de Castro, 2013).

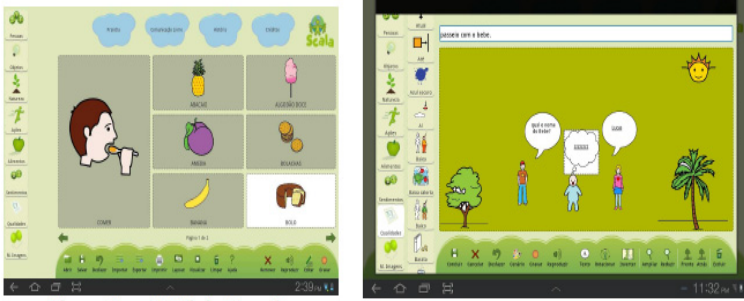
It was thought therefore, a computing platform that assists users, family and school to participate in these scenarios, integrating them. As a focus of research, we chose subjects with difficulties in social interaction as children with Autistic Spectrum Disorder more specific Syndrome of Autism, with motor and speech difficulties. Communication skills are fundamental in the development of social interaction, as they allow to establish reciprocity. People who have deficits in communication often need to use additional supplementary means of communication or magnifiers, called Alternative Communication (AC) (Passerino, 2013 Bez and Passerino,2009).

2 SCALA and SiestaCloud

According to Von Tetzchner and Martinsen (2000) and Glennen (1997), alternative media is all communicative practice that differs from speech and that is used in contexts of communication face to face, replacing it. The concept of Alternative Communication aims to define the different forms of communication such as gestures, sign language, facial expressions, and even the use of software capable of supporting communication. The AC term is used in this study as all forms of communication to replace, supplement or extension of orality (Bez, 2012). A designed and developed to support the process of language development in individuals with autism, called SCALA (System of Literacy Alternative Communication for People with Autism) project is presented as an alternative in the care and support homeschooling this user with difficulty in communication and speech. The project SCALA began in 2009 and the main goal is to support the process of language development in children with autism and communication deficits, epistemologically grounded in theory. In 2011, SCALA becomes SCALA 2.01 being a multiplatform application (Passerino, de Castro, 2013). Initially tested with three autistic children and three different contexts: school, family and university research lab. The SCALA has two modules: board (Figure 1a) and stories (Figure 1b) and was developed under the GNU and Creative Commons licenses to ensure its open content. The pictograms used in the system were mostly developed by ARASAAC2 group. With the use of these images and the images themselves, the SCALA has over 4000 (four thousand) images, divided into the categories: People, Objects, Nature, Stock, Food, Feelings, Qualities and My Pictures, where the user has the option inserting own image on the system (Passerino, de Castro, 2013).

¹ <http://scala.ufrgs.br>

² The stock images used in SCALA were translated from pictographic symbols CATEDU (<http://catedu.es/arasaac/>) under the Creative Commons license.



(a) - Module Board Figure

1 (b) - History Module

Fig. 1. Interface Scale (Source: SBIE, 2013)

As result of over 25 years of research and development EATCO group at the University of Cordoba, Spain, the SiestaCloud is a cloud platform complemented with an operating system based on Siesta Local GNU / Linux installable on settop-box or computer (de Castro, 2011). For De Castro (2011) SiestaCloud is an ecosystem, because it is a set of applications, operating system and cloud platform whose main aim is to give conditions for development to people in situations of dependency as for example the elderly, people with disabilities, people hospitalized. For this reason, the SiestaCloud was developed following international standards for accessibility and usability (Bevan, 2012). The SiestaCloud, which can be seen in Figure 2, is part of an interface that aggregates multiple software, plus a user-friendly interface, with icons, taskbar, integration with other tools and software.



Fig. 2. Siesta Cloud Platform and the differents technological devices (Source: RED 32, p. 1-43)

The SiestaCloud has a model of homecare, using known feature of most people and internalized by them, like TV. The interaction is via a remote control with six colored keys and the interaction is reduced to six types of events that can be six movements, gestures and voices. Can be customized as for users(Castro,Burón,Sainz y García, 2011). This system was developed using criteria of usability, accessibility and is

adaptive, so it is intended to cover the greatest number of people possible. Following the text this research presents usability and accessibility issues and the use of these criteria in the development of a software.

Supported by the Government of Brazil and Spain, both research groups and develop technologies for special education and teamed to integrate two of this mentioned platforms.

3 TAC-ACCESS - Assistive Technology for Communication to Accessible and Multimodal Interfaces for People with Disabilities and Diversity

The TAC-ACCESS-Assistive Technology for Communication Design from accessible and multimodal interfaces for people with disabilities and diversity, emerges as a research project and technology development of technology, information processing, multimodal applications and interfaces technologies applied to the field of inclusion (Passerino, Bez, de Castro, Salcines, 2013). It is also a cooperation research of the Brazilian Government and the Ministry of Education of Spain that aims to integrate this two software and share experiences and knowledge. The methodology of this study consisted of a case study, supported by Yin (2005), unfolding in three stages, which will not occur in full sequence, because of the numerous resumptions of steps performed during the research (Passerino, 2011). The step of integration is still being modeled and designed. As both software already have the characteristic of being accessible and usable, it is thought to adding functionality. Add the public with communication difficulties served by SCALA and Siesta with its multi-platform tool. Following to the definition of a method for evaluating the usability and accessibility of integrated product (shown in this article), the next step is validation of the tool with the autistic children, with families and professionals/teachers and after applying questionnaires. The last step was a check on the system usability in inspections and usability tests. Some questions about integration are made and this articles elect one of the questions to be answered . What protocols usability analysis can be built to meet the diversity of Universal Design including usability and accessibility? To answer this question some research on which method to be applied in evaluating the usability of these two integrated software

"A systematic review responds to a clearly formulated question using systematic and explicit methods to identify , select and critically Avalar relevant research and collect and analyze data from the studies included in the review (Clark , 2001)".

Was chosen three methods to evaluate usability. Based in methods already used in both of the projects, was studied what methods of evaluation that contemplates the process of development of software on which the community help in this process. The Methods of User Centered Design (UCD), the Think Aloud Protocol and Context-Centered Design of Usage (DCC) were investigated. With this, we intend to answer a corresponding question made by the project reported here and define the method that

will be associated with the context of this research, the evaluation of the platform, the start of the integration to the application. Then we checked the table with the relationship of these methods (Table 1). To present the characteristics of each one of the methods was used the Human Computer Interaction concepts: requirement analysis, design, prototype and evaluation.

Table 1. Methods of evaluating usability analyzed

<p><i>The User-Centered Design (UCD)</i></p>	<p>This system is design based on users necessities and uses his help in all the steps of development. <i>Requirements analysis:</i> Determine the target audience, platforms, targets the subject, technical requirements, the need of the subject and usability requirements. <i>Design:</i> Use cases, task analysis, navigation and search systems <i>Prototype:</i> Drawings, documents, storyboards, mock-ups, scenarios, videos. <i>Evaluation:</i> Inspection, testing and questionnaires, evaluating usability</p>
<p><i>Context-Centered Design of Usage (CCD)</i></p>	<p>It constitutes the basis of the subject in context, bringing a design that transcends the focus only on a profile of final user and shall also be concerned with the educational and family context that this subject is submerged (Passerino, 2011). <i>Requirements analysis</i> to define the profile of the user, profiling the living environment (family, school, community) which the skills of the user, how he interacts in the environment they live <i>Design:</i> observation, interviews, questionnaires (professional and family), analysis of documents, theoretical framework. <i>Prototype:</i> definition of the user's profile, communication strategies, building on the elements of the context, defining the steps to be gradually developed in the prototype interaction with the user <i>Avaliação:</i> interviews, step-by-step guide(containing a list of necessary equipment and aspects to be highlighted to previously user)</p>
<p><i>Think Aloud Protocol</i></p>	<p>This procedure is to encourage participants to verbalize during use of the product/system, all your thoughts. To make "visible" to the researcher, what is hidden within the mind of the participant. Thus, the researcher will have access in real-time, relevant information on the mental map of the users, their doubts, their difficulties, their reasoning, where they're looking at what they are feeling, etc. (Ericsson, Simon, 2010). <i>Requirements analysis:</i> Test program, mindmap <i>Design:</i> observation notes, video recording, audio recording, transcript <i>Prototype:</i> analysis by user software in a mental organization, pointing out every step and what their difficulties, doubts, improvements <i>Evaluation:</i> Reviewed from observations, notes, finally all of recorded documentation analyze what were the reviews.</p>

3.1 Choosing the Method of Usability

The software of alternative communication SCALA such SiestaCloud which will be used by groups of people with disabilities. Scala does not need to be used only by autistic person but can be used by people who are illiterate, blind with motor disabilities. The Siesta covers a group of tools that can be used on any person in distress and with a friendly and comfortable interface being operable on multiple devices. With this, it is necessary joining methods and usability and accessibility protocols that will be important for the final product and mostly reach your goal. The studies related to the design of HCI (Human Computer Interaction) refer how to build interfaces with high quality. For this purpose, methods, models and guidelines are defined. The studies related to the assessment of HCI, in turn, seek to evaluate the quality of an interface design, both along the development process as when the software is ready (Barbosa and Prates, 2000). Within the project will be defined as the interactions between the user and the machine or as PREECE (et al. 1994) Interaction says is the process of communication between people and interactive systems. Have the interface is a part of the system in which the user will interact, use. Comprises both software and hardware.

The physical dimension includes the elements of the user interface can handle, while the perceptual dimension encompasses those that the user can understand. The conceptual dimension results from processes of interpretation and reasoning triggered by user interaction with the system, based on its physical and cognitive characteristics, their goals and their work environment (Barbosa and Prates, 2000).

It is important to know the project is developing the software supports users in their tasks and work environment. As functionality tests are needed to verify the robustness of the implementation, evaluation of interface is needed to assess the quality of use of software. The earlier the problems are found interaction or interface, the lower the cost to repair them (Barbosa and Prates, 2000). After the project is ready, we need to attest to their quality.

Therefore, tests will be done, can be the designer or user defined and must be selected in the method of evaluation. This quality or quality of use is defined as "the ability and ease of users achieve their goals with efficiency and satisfaction (Barbosa and Prates, 2000)."

Within this general concept of quality of use, the most widely used is the usability. The definitions of the authors Pierce et al..

- . **Ease of Learning:** Refers to the time and effort spent on each task. Should be taken into account the level of user knowledge as well as their level of training with the tool.

- . **Ease of use:** It can be related to the cognitive effort to interact with the tool and with the mistakes made during the interaction.

- . **Use efficiency and productivity:** is to analyze whether the system does well what it is intended. Have the productivity factor serves to evaluate whether the user can do what they need quickly and effectively (Barbosa and Prates, 2000).

- . **User satisfaction:** subjective user evaluation system utilization, emotions, pleasure, frustration, negative feelings or positive.

- . **Flexibility:** how the system is able to adapt to the basic, intermediate and advanced user , but they reach the same goal .
- . **Functionality:** set of features for user to perform a task .
- . **Security Usage:** Be able to recover the information system in case of a problem.

For a typical system life cycle of software development steps: analysis-design-design-prototype-test-maintenance. These systems are not used the user opinion, and even was part of the development. New perspectives and paradigms in software development where the relationship to user interaction with the system, such as human-computer interaction. Within this methodology HCI appears the User Centered Design Method - DCU (Figure 3). This model does not replace a classic development methodology, but it is included in one of its phases. It is a cyclical process, focused on the user in each interaction produces a fully functional prototype design according to his analysis that undergo reviews by users. The results are taken to start the cycle again until the need to model and intended end-user.

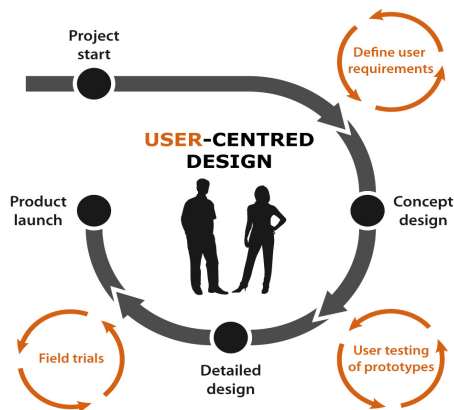


Fig. 3. Model of User-Centered Design. (Source : UCD process diagram (© Tom Wellings).

In this research study the epistemological basis of Scala and Siesta Cloud systems is socio-historical, both design development and implementation. This involves a conceptual reorganization of software development known as User Centered Design (UCD) for a Context-Centered Design of Usage (CCD) that exceeds the analysis only the user-object interaction and focuses on processes of user-object interaction process-user, wick the object is established as an instrument of mediation. (Passerino, Bez,2013; Avila, Passerino, 2011; Passerino, Bez and Avila, 2010; Bez, Passerino, 2009). The theoretical assumptions that guide the work the approach does not address only the user with disabilities, but this guy in interaction with others, which broadens the focus of research to:

- (a) the social contexts in which
- (b) cultural practices of communication and literacy are developed by
- (c) other participants through
- (d) mediating processes.

Thus, the general guidelines of CCD consider this macro context of human development in social interaction as the basis for the analysis of cases without isolating the characteristics and needs of individuals from their contexts. This difference is to avoid what usually happens in the development of Assistive Technology, which focuses on a functional view of human beings. The proposed system is not to ignore the functional aspects, but consider these within the cultural context in which an individual is inserted, preferably aiming its expansion (Passerino, Bez, Vicari, 2013). Thus, the focus is always the user in relation to their different contexts, in a mediation process that will learning to human development (Vygotsky, 1988). Each context sets our relations, so the possible mediations in a space-time dimension (Passerino, Bez, 2013). The configuration settings through the social-historic research, and is the macro research necessary for understanding the phenomenon of communication within the educational space level. On a micro level, the triads user-agent, non speaker-user and mediating processes are the starting point for understanding the processes of mediation technologies . Put another way, what people do in different contexts, with different goals and scenarios is the development of the system (Passerino, Bez, Vicari, 2013). Therefore, from the research and the need to use a method that is consistent with the theoretical basis of the researchers and the user's needs and its context, the CCD method was chosen. To understand this concepts visually, a figure is show (Figure 4).

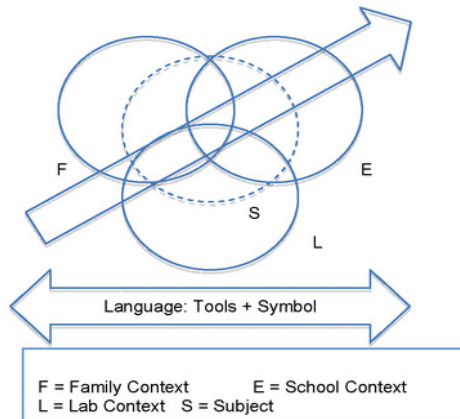


Fig. 4. Scheme of Context-Centered Design (CCD). (Passerino, Bez, 2014).

It is believed that learning and development of the user not only occurs for using one tool, but rather by the joint operating behind, supporting the person, like family, professionals, teachers. All of these contexts will be analyzed to form the design of the integration project. Throughout the construction process of integration between the SCALA plus SiestaCloud system occurs in parallel to a case study to develop strategies for communicating with a child with autism does not oral language. During this part of the research, collection instruments will be used as participant

observation, interviews with people close to the child and document analysis which served to define not only communication strategies to be used, but as the Scala plus SiestaCloud should be built to contemplate the peculiarities of this user profile. Thus, in every interaction with the child, there will be new data that will be analyzed and put into discussion with the research group in charge of building the system. As well as strategies developed for communication with the child they help with the design and evaluation of SCALA plus Siesta, this served as a support for the inclusion in educational activities and homecare tool in a dialectical process where the interactions affecting the tool and this, in turn, directly affected the communication strategies (Avila, Passerino, 2011).

At the end of this part of the study, as seen in the closing of the research will be conducted the second part of the evaluation of Scala plus Siesta, which is geared specifically for educators who would work with the tool. During this stage, the usability evaluation of the prototype software will be made. The evaluation process will be divided into two parts: inspection and assessment tests. The inspection will be conducted usability, featuring a set of ten heuristics listed by Nielsen (1993) will be verified if the usability of the system is consistent with what would be expected by the research subjects. Already in the case of assessment tests, educators who work with children with deficits of communication who will be invited to review the system from the same set of heuristics are selected. Each participant will have an individual session inspection system, which mediates research, will lead participants along the proposed activities. The Think Aloud (Nielsen, 1993) method, which consists of the user speak aloud all the steps that runs in the system will also be used. Thus, the researcher has access not only to the results obtained by the user but also their cognitive structures established during the interaction with the tool.

A brief survey regarding the usability of software separated Siesta Scala and a start was made for analysis, shown in the description of each tool at the beginning of this article. The analysis in each software (Scala and Siesta), but at the time of integration believes that the concepts of usability and accessibility will be covered in full, using the principles of usability heuristics of Nielsen.

4 Results and Ongoing Research

Through this article showed the method and usability evaluation that will be used in the integration of two software programs that include diversity. Scala, a software alternative communication that purposes to be an aid in the process of developing language and communication in autistic children or person with communication deficit and SiestaCloud which is a set of applications, operating system and cloud platform whose main aim is to give conditions for development to people in situations of dependency as for example the elderly, disabled, hospitalized persons, among others. In this section we briefly describe our preliminary results and the progress that has been taking this survey.

At the moment, the SCALA is integrated to a TV Siesta beta, being used by both groups for validation of operational functionality. Adjustments are being made to

ensure the integration of SiestaCloud interface model while retaining the essential settings. The colors of SCALA were also maintained to preserve the identity of the system and also because research has been done and the green color is the color that calms autistic users (information extract from graduate paper). With the requirements and modeling which are being developed, as a result we have also our first prototype to be evaluated in the field through the year 2014 (between February and March) .

The movements of this research provide a review of the software with children with autism who have not developed their orality and literacy in schools and in particular public service in the user's residence in the city of Córdoba in Spain, in a pilot project, after the analyzes and assessments apply in charter schools and in attendance at the residence of the user of Porto Alegre in Brazil. Making comparison between them. In parallel the same way, the application software will also be made with public school teachers and working with user. with autism, both of Spain, as in Brazil. In these interactions, strategies for the development of orality and literacy of the user, through the software should emerge as final results of this research.

References

1. Passerino, L.M.: Aprendizagem: estudo dos processos de Interação Social e Mediação. Tese (Doutorado em Informática na Educação) – UFRGS – Programa de Pós- Graduação em Informática na Educação. Porto Alegre (2005)
2. Avila, B.G., Passerino, L.M.: Comunicação Aumentativa e Alternativa para o Desenvolvimento da Oralidade de Pessoas com Autismo. Porto Alegre:PPGEDU da UFRGS, 2010. 103 p. Proposta de dissertação – Programa de Pós-graduação em Educação, Universidade Federal do Rio Grande do Sul (2010)
3. Bevan, N., Macleod, M.: Usability measurement in context. *Behaviour and Information Technology* 1&2(13)
4. Bez, M.R., Passerino, L.M.: Applying Alternative and Augmentative Communication to an inclusive group. In: WCCE 2009 - Education and Technology for a Better World Monday, Bento Gonçalves (2009)
5. Bez, M.R.: Sistema de Comunicação Alternativa Para Processos de Inclusão em Autismo: uma proposta integrada de desenvolvimento em contextos para aplicações móveis e web. 2012. 130 p. Proposta de Tese. Programa de Pós-Graduação em Informática na Educação, UFRGS, Porto Alegre (2012)
6. Clarke, K.R., Warwick, R.M.: Change in marine communities: An approach to statistical analysis and interpretation, 2nd edn. PRIMER-E, Plymouth (2001)
7. de Castro Lozano, C., Fernández, J.B., de Abajo, B.S., Salcines, E.G.: SieSTA Project: Products and Results. In: Cipolla Ficarra, F.V., de Castro Lozano, C., Pérez Jiménez, M., Nicol, E., Kratky, A., Cipolla-Ficarra, M. (eds.) ADNTIIC 2010. LNCS, vol. 6616, pp. 171–181. Springer, Heidelberg (2011)
8. de Castro Lozano, C., Fernández, J.B., de Abajo, B.S., Salcines, E.G.: SieSTA Project: Products and Results. In: Cipolla Ficarra, F.V., de Castro Lozano, C., Pérez Jiménez, M., Nicol, E., Kratky, A., Cipolla-Ficarra, M. (eds.) ADNTIIC 2010. LNCS, vol. 6616, pp. 171–181. Springer, Heidelberg (2011)
9. Glennen, S., Decoste, D.C.: The handbook of augmentative and alternative communication. Edition: illustrated. Publicado por Cengage Learning (1997)
10. Salviteri, G.I., Lores, T.: Engineering Process Model, Integration with Software Engineering. In: Proceedings of HCI Intl. 2003, Crete, Greece (2003)

11. Salviteri, G.I.: Toni. Mplu+a. Uma metodologia que integra la ingenieria del software, la interacción persona-ordenador y la accesibilidad en el contexto de equipos de desarrollo multidisciplinares. Tesis de doctorado, Universidad de Lleida, julio (2004)
12. Gregorc, A.F.: The mind styles model: Theory, principles and applications. Gregore associates, Columbia (1894)
13. Hassan Montero, Y.: Introducción a la Usabilidad. En: No Solo Usabilidad, vo.1 (2002) ISSN 1886-8592 - See more at:
http://www.nosolousabilidad.com/articulos/introduccion_usabilidad.htm#sthash.Dj1LzMpG.dpuf
14. IFIP WCCE Proceedings - Education and Technology for a Better World Monday, Germany, vol. 1, pp. 164–174 (2009)
15. de Castro Lozano, C.: El futuro de las tecnologías digitales aplicadas al aprendizaje de personas con necesidades educativas especiales - RED. Revista de Educación a Distancia (2012)
16. Mace, R., et al.: The Universal Design File: Designing for People of All Ages and Abilities (2002)
17. Miranda, T., Galvão Filho, T.: O professor e a educação inclusiva: Formação, práticas e lugares. Salvador/BA: Editora UFB 1, 217–240 (2012)
18. Montoya, S.R.: Capacidades visibles, tecnologías invisibles: Perspectivas y estudio de casos. nuevos escenarios, nuevas oportunidades. Murcia: Consejería de Educación y Cultura (2006)
19. Nielsen, J.: Usability Engineering. Morgan Kaufman, San Francisco (1993)
20. ONU – Organização das Nações Unidas, <http://www.onu.org.br/a-onu-em-acao/a-onu-e-as-pessoas-com-deficiencia/>
21. Passerino, L.M.: Comunicação alternativa, autismo e tecnologia: estudos de caso a partir do Scala. SBIE (2013)
22. Avila, B.G., Passerino, L.M.: Comunicação Aumentativa e Alternativa e Autismo: desenvolvendo estratégias por meio do SCALA. In: Anais VI Seminário Nacional de Pesquisa em Educação especial: práticas pedagógicas na educação especial: multiplicidade do atendimento educacional especializado, vol. 1, pp. 1–10 (2011)
23. Passerino, L.M.: Anjos Tecnológicos na Torre de Babel: reflexões sobre o uso da Comunicação Alternativa em dispositivos móveis. In: Brito, M.C., Misquiatti, A (org.). Transtornos do Espectro do Autismo e Fonoaudiologia: atualização multiprofissional em saúde e educação
24. Prates, R.O., de Souza, C.S., Barbosa, S.D.J.: A Method for Evaluating the Communicability of User Interfaces. Interactions 7(1), 31–38 (2000)
25. Preece, J., Rogers, Y., Sharp, H.: Design de Interação: Além daInteração Homem-Computador. Bookman, Porto Alegre (2002)
26. Rodríguez, J., Montoya, R., Soto, F.J. (coords.): Las tecnologías en la escuela inclusiva:
27. Smith, T.F., Waterman, M.S.: Identification of Common Molecular Subsequences. J. Mol. Biol. 147, 195–197 (1981)
28. Tecnologia Assitiva, <http://www.assistiva.com.br/tassistiva.html>
29. UN – United Nation,
<http://www.un.org/disabilities/default.asp?id=18>
30. Von Tetzchner, S., Martinsen, H.: Introdução à Comunicação Aumentativa e Alternativa. Porto, Portugal (2000)
31. Yin, R.K.: Estudo de Caso: Planejamento e Métodos, 3rd edn. Bookman, Porto Alegre (2005)
32. Vygotsky, L.S.: A Construção do Pensamento e da Linguagem (texto integral traduzido do russo). Martins Fontes, São Paulo (2001)
33. Passerino, L.M., Bez, M.R., Vicari, R.M.: Formação de professores em comunicação alternativa para crianças com TEA: Contextos em ação. Revista da Educação Especial 26(47), 619–638 (2013)