Communication Support for Older Adults Through Pictograms

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Abstract. Changes generated by the pandemic have stimulated new forms of communication through technological devices. Thanks to these, augmentative and alternative communication through the use of pictograms has allowed the development of communicative capacity for people who face health problems, such as speech, limited motor skills, hearing, among others. In particular, for segments of the elderly population with limited communication and technology management skills, it is important to consider usability and accessibility criteria in technological support interfaces design, in order to provide a satisfying and non-intrusive user experience. Support activities must be pleasant and transparent for the effective users' communication with their environment. In this context, the article presents a methodology for the design of an augmentative communication solution based on pictograms, with the purpose of transmitting the message from the user to the receiver. This article proposes a systematic review of the literature on augmentative and alternative communication, as well as the use of existing pictograms and technologies. The systematic review protocol considered the choice of four digital libraries for the search. The method of search and selection of technological solutions was based on the search for Apps and websites for the use of pictograms through technology to automate and support the communication of elderly.

Keywords: older adults · pictograms · augmentative and alternative communication · technology

1 Introduction

Communication is a basic need for everyone. It is an exchange of feelings and needs and develops from childhood to adulthood through natural language [1]. In this sense, language has the function of representing ideas about the world, adding values and concepts to communicative symbols, allowing face-to-face interpersonal interactions. When conveying a message, people use a language that, whether spoken, written, or signed, encompasses a system that expresses meaning [2].

With aging, certain cognitive abilities tend to decline. Some people may experience mild cognitive impairment, which makes it difficult to correctly execute some cognitive processes. However, there are many people who have a disability that prevents communication through natural language [3]. The most common problems faced by an older adult are related to communication and particularly to speech, among these are: dysarthria, apraxia, stuttering, voice disorders [4].

This phenomenon became even more visible during the COVID-19 pandemic, since family contact was lost as a precaution against contagion, creating greater vulnerability, since their abilities to take advantage of the opportunities offered by digital transformation are relatively lower than those of the youngest groups [5].

In this sense, communication through new technologies becomes a challenge for the elderly, given certain motor or visual restrictions; Hence, every time an older adult needs to communicate through text messages through the different existing services, it is complicated due to the imprecision of their movements or the lack of vision typical of their age, compared to interfaces with buttons or small texts not suitable for their reality. In general, the performance deficit of the elderly using technology is not due to a lack of experience or usability problems, but rather to their cognitive conditions [6].

Augmentative and Alternative Communication (AAC) technologies for people with communication needs within society have substantially increased expectations for participation and engagement in a wide range of settings [7, 8]. Computer solutions have been developed that include the use of iconographic symbols that support the communication of whoever requires it. Particularly, these systems have been used for social skills development in people with autism spectrum disorder or intellectual disabilities [9], such as the proposal of the Sc@ut communicators that include three types of language: pictograms, spoken language and animations that show gestures, and are especially intended for communicative learning. They are an attractive medium for training, increase motivation and facilitate communication for people with intellectual disabilities [10].

Despite advances in high-tech research, existing methods and technologies are still insufficient to meet the functional communication needs of older adults who need support. Hence, this research sought to consolidate the findings of current research on the intervention of specific AAC for these people. A systematic review was conducted to identify and assess relevant research.

2   Method

This research used literature systematic review methodology on augmentative and alternative communication, such as the use of pictograms and existing technologies, with the aim of understanding the topic analyzed, in order to synthesize the evaluated studies, contributing to automate and support the communication of older adults. The steps followed for the construction of the review were: definition of the research question, establishment of the inclusion and exclusion criteria through a bibliographic search, definition of the information to be extracted from the studies, evaluation of the included studies, results interpretation and review presentation [11].

To guide the research survey and discussion, the following research question was raised: What technologies, methods, strategies and tools are used for the implementation of AAC for older adults communication?

2.1 Research Strategy

For the articles survey, a period from 2013 was considered, in the following databases: Public Medicine Library (PubMed), Scientific Electronic Library Online (SciELO), Scopus (Elsevier) and Web of Science. A search was made for the descriptors in English: 'alternative and augmentative communication', 'elderly adults' and 'pictograms'. The terms used were combined with the Boolean AND operator in each database.

2.2 Inclusion Criteria

Full access articles available in the databases published in English, studies from the last 10 years (2013 to 2022) that addressed the topic of augmentative and/or alternative communication, older adults, and pictograms.

2.3 Exclusion Criteria

Duplicate articles, articles carried out with children, reviews, and those that were not available in open access in the databases were discarded.

2.4 Data Collection and Analysis

The articles were searched and identified, the titles and abstracts were evaluated, followed by the complete reading and the final selection of the articles by the authors, considering the inclusion and exclusion criteria proposed for the review.

3 Literature Revision

The systematic review protocol considered the choice of four digital libraries for the search. The authors searched for articles published from 2013, considering the studies that used augmentative and/or alternative communication for older adults and their impact on communication. With these selection and exclusion parameters, eight articles were included in the analysis.

From the search in the selected databases, 79 articles were found. Of these, 36 were excluded because the full text was not available and also because it was not in English. After reading the titles, 25 were discarded for not addressing the topic "augmentative and/or alternative communication" and 6 after reading the abstracts, for the same reason.

After the complete reading of the articles, one was excluded for not using the strategies of interest and one was a review work.

Regarding the country of publication, two were developed in the United Kingdom [12, 13] (25.0%) and two in South Africa [14, 15] (25.0%) and only one study was identified for each of the following countries: Japan [16], Australia [17], South Korea [18]

and Italy [19]. Regarding the family environment, three [12, 14, 15] (37.5%) addressed issues of friendship, conversation as a couple and quality of life and two [17, 18] (25.0%), considered care in hospital environments.

Regarding the research participants, six studies (75.0%) were carried out with people with some communication disability, two studies (25.0%) with people without disabilities and two studies (25.0%) included support staff and family members.

Table 1. Characterization of the studies selected for this review (n = 8)

Ref	Document title	Author	Year	Country	Participants	Strategies	Results
[13]	A voice-input voice-output communication aid for people with severe speech impairment	Hawley et al.	2013	United Kingdom	People with dysarthria	Voice input and voice output communication support (VIVOCA)	The test highlighted some issues that limit the performance and usability of the device when applied in real use situations, with an average recognition accuracy of 67%
[16]	Comparison of Four Control Methods for a Five-Choice Assistive Technology	Halder et al.	2018	Japan	Healthy people	Comparison of two visual systems (a visual P300 brain-computer interface (BCI) and an eye tracker) and two non-visual systems (an auditory and a tactile P300)	The performance between the eye tracker and the visual BCI was strongly correlated, the correlation between the tactile and auditory BCI performance was less
[12]	Voice banking for people living with motor neurone disease: Views and expectations	Cave et al.	2021	United Kingdom	People living with motor neuron disease	Voice banking, voice that creates an approximation of the person's own voice	Preserving identity is the main motivation in decision-making for voice banking, which limited the decision to use it in the participants
[17]	An exploration of communication within active support for adults with high and low support needs	Iacono et al.	2019	Australia	People living in group homes	Communication for people in group homes with high and low support needs	Receiving good communication was associated with higher levels of engagement

Table 1. (*continued*)

Ref	Document title	Author	Year	Country	Participants	Strategies	Results
[14]	The self-determined and partner-predicted topic preferences of adults with aphasia	Beringer et al.	2013	South Africa	People with aphasia	The Talking Mats™ framework was used to score 37 topics	Adults with moderate to severe aphasia in this study were able to communicate their topic preferences when provided with the Talking Mats™ framework
[15]	Friendship Experiences of Young Adults Who Use Augmentative and Alternative Communication	Dada et al.	2022	South Africa	People with physical disabilities	Semi-structured interviews	Four themes were identified, namely companionship, friendship quality, the desire for independence, and the role of technology in mediating friendships
[18]	The Effect of AAC Display Types on Message Production and Its Relationship with Reading Ability in Patients with Cognitive-Communication Disorders	Kim et al.	2022	South Korea	Patients with cerebrovascular accidents	Message production capabilities were examined by measuring accuracy scores and response times in three AAC viewing conditions	The graphic symbol-based GRID showed significantly high accuracy scores and short response time compared to the text-based VSD
[19]	Writing with the Eyes: The Effect of Age on Eye-Tracking Performance in Non-Disabled Adults and a Comparison with Bimanual Typing	Caligari et al.	2021	Italy	Healthy people	Eye tracking communication devices and a standard keyboard were used	Age had a negative impact on performance: as age increased, typing speed decreased and error rate increased

Three studies used low-tech strategies (37.5%) and referred to pencil, paper, gestures, and pictograms. Six studies (75.0%) used high-tech strategies, with voice-generating devices, eye tracking, and software. The synthesis of the articles covers the following data: author, year, country of publication, title, participants, strategies used and results, which are presented in Table 1.

4 Discussion and Conclusions

From the articles analyzed, it was possible to identify that the impossibility of verbal communication compromises the family and social relationship, which generates frustration. The use of augmentative and alternative communication technologies is an effective communication option in the environment of people with communication problems, generating an improvement in their quality of life, this goes in harmony with the intervention that should consider strategies functional and non-linguistic clues for communication [20].

The use of high-tech tools employs symbolic means in association with resources, such as voice-generating devices, specific software, and some resources that have automatic scanning [1, 7]. Evidence suggests that these tools increase communication, improve quality of life and psycho-emotional issues, in addition to allowing communication exchanges between the patient and their environment [3, 10].

References

1. Carvalho, D., Queiroz, Í., Araújo, D., Barbosa, S., Carvalho, V., Carvalho, S.: Augmentative and alternative communication with adults and elderly in the hospital environment: an integrative literature review. Rev. CEFAC **22**(5), e16019 (2020)
2. Moreschi, C.L., Almeida, M.A.: A comunicação alternativa como procedimento de desenvolvimento de habilidades comunicativas. Rev. Bras. Educ. Espec. **18**(4), 661–676 (2012). https://doi.org/10.1590/S1413-65382012000400009
3. Hervás, R., Bautista, S., Méndez, G., Galván, P., Gervás, P.: Predictive composition of pictogram messages for users with autism. J. Ambient Intell. Hum. Comput. **11**(11), 5649–5664 (2020). https://doi.org/10.1007/s12652-020-01925-z
4. MedlinePlus. Deterioro del lenguaje en adultos (2023). https://medlineplus.gov/spanish/ency/article/003204.htm
5. BBVA. La brecha digital que desconecta a nuestros mayores en la crisis del coronavirus (2020). https://www.bbva.com/es/es/la-brecha-digital-que-desconecta-a-nuestros-mayores-en-la-crisis-del-coronavirus/. [Último acceso: 15 12 2022]
6. Callari, T.C., Ciairano, S., Re, A.: Elderly-technology interaction: accessibility and acceptability of technological devices promoting motor and cognitive training. Work **41**, 362–369 (2012). https://doi.org/10.3233/WOR-2012-0183-362
7. Light, J., et al: Challenges and opportunities in augmentative and alternative communication: Research and technology development to enhance communication and participation for individuals with complex communication needs. Augmen. Altern. Commun. **35**(1), 1–12 (2019)

8. Fager, S.K., Fried-Oken, M., Jakobs, T., Beukelman, D.R.: New and emerging access technologies for adults with complex communication needs and severe motor impairments: State of the science. Augmen. Altern. Commun. **35**(1), 13–25 (2019). https://doi.org/10.1080/07434618.2018.1556730

9. Morin, K.L., et al.: A systematic quality review of high-tech AAC interventions as an evidence-based practice. Augmen. Altern. Commun. (Baltimore, Md.: 1985) **34**(2), 104–117 (2018)

10. Rodríguez-Fórtiz, M.: Sc@ut: developing adapted communicators for special education. Procedia – Soc. Behav. Sci. **1**(1), 1348–1352 (2009)

11. Mendes, K. Silveira, R., Galvão, C.: Revisão integrativa: método de pesquisa para a incorporação de evidências na saúde e na enfermagem. Texto contexto enferm **17**(4), 758–764 (2008)

12. Cave, R., Bloch, S.: Voice banking for people living with motor neurone disease: views and expectations. Int. J. Lang. Commun. Disorders **56**(1), 116–129 (2021)

13. Hawley, M.S., et al.: A voice-input voice-output communication aid for people with severe speech impairment. IEEE Trans. Neural Syst. Rehabil. Eng. **21**(1), 23–31 (2013). https://doi.org/10.1109/TNSRE.2012.2209678

14. Beringer, A., Tönsing, K., Bornman, J.: The self-determined and partner-predicted topic preferences of adults with aphasia. Aphasiology **27**(2), 227–251 (2013). https://doi.org/10.1080/02687038.2012.744809

15. Dada, S., Tonsing, K., Goldbart, J.: Friendship experiences of young adults who use augmentative and alternative communication. Int. J. Disabil. Develop. Educ. **69**(3), 951–975 (2022). https://doi.org/10.1080/1034912X.2020.1746246

16. Halder, S., Takano, K., Kansaku, K.: Comparison of four control methods for a five-choice assistive technology. Front. Hum. Neurosci. **12**,(2018). https://doi.org/10.3389/fnhum.2018.00228

17. Iacono, T., Bould, E., Beadle-Brown, J., Bigby, C.: An exploration of communication within active support for adults with high and low support needs. J. Appl. Res. Intellect. Disabil. **32**(1), 61-70 (2019)

18. Kim, M., Shin, S.: The effect of AAC display types on message production and its relationship with reading ability in patients with cognitive-communication disorders. Commun. Sci. Disorders **27**(1), 107–118 (2022)

19. Caligari, M., Giardini, M., Arcolin, I., Godi, M., Corna, S., Colombo, R.: Writing with the eyes: The effect of age on eye-tracking performance in non-disabled adults and a comparison with bimanual typing. Comput. Intell. Neurosc. **2021**, 1–9 (2021). https://doi.org/10.1155/2021/9365199

20. von Tetzchner, S., Øvreeide, K., Jørgensen, K., Ormhaug, B., Oxholm, B., Warme, R.: Acquisition of graphic communication by a young girl without comprehension of spoken language. Disabil. Rehabil. **26**(21), 1335–1346 (2004)