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Accessibility limitations of video conference tools for people with cognitive disabilities during COVID-19

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Abstract — **COVID-19 outbreak has changed the learning paradigm towards a remote mode where video conferencing tools play a greater role. However, this approach presents accessibility issues for inclusive learning for people with cognitive disabilities. This study sought the experiences of relatives and autism spectrum disorder experts in using video conferencing tools for online learning throughout the pandemic. The data was collected through a survey and a thematic analysis was applied to identify the main accessibility factors that affected this group. Themes identified were: (i) complex UI (user interface), (ii) design for autonomy, and (iii) attention management. This study highlights the accessibility barriers of video tools for people on the spectrum and provide some suggestions to overcome them.**

Keywords - accessibility; video tools; cognitive disabilities; inclusive learning.

I. INTRODUCTION

In recent years, education has faced challenges in respecting diversity and creating inclusive environments in which people with disabilities can participate and have equal access to learning opportunities. Among the special needs to attend to are those of people with cognitive disabilities, whose learning is affected by their impairments in memory, decision making and problem solving. Cognitive disabilities are present in numerous developmental, such as autism spectrum disorder.

Reported cases of autism are increasing worldwide [1]. People with autism are characterized by varying levels of deficiencies in social interaction, communication, and repetitive behaviours. They usually also have some degree of learning disability [2], requiring supportive therapies and assistant to support their education. If regular learning settings were already complicated for them, the drastic shift to distance education due to the pandemic, with greater use of digital resources, posed a great e-inclusion challenge for them. Even though the use of video conference tools became essential for the new educational paradigm, this method and learning resource were not initially designed for inclusion.

II. BACKGROUND

Video conference platforms have been widely used over the years. However, COVID-19 outbreak made a huge impact on this type of software, as they became an essential tool for personal and professional purposes, as well as for education. Consequently, the accessibility of many of these tools was put under scrutiny. An accessible tool would be one that covers all the needs that a user may require [3], regardless of their functional diversity.

Despite the efforts that software companies have made to improve the quality of video calls, including advanced features and effects, and to make large group meetings possible, these applications present some barriers in terms of accessibility, especially for people with intellectual disabilities [4].

For instance, Hersh, Leproni and Buzzi [5] concluded that many of the available solutions for video conferencing have accessibility limitations, such as a lack of screen reader integration, complex methods to share files, etc. The authors' recommendation points to general web accessibility guidelines as a starting point.

Additionally, Moreno, Martínez and Alarcon [6] carried out an extensive study of requirements that video conferencing tools must fulfil to be accessible. From their study, they presented a set of design patterns that developers should follow.

Although researchers strive to study and provide guidelines and solutions to make software more accessible, there is still room for improvement, especially in the case of cognitive disabilities, which still seem to be under-considered in these studies.

III. METHODOLOGY

A. Procedure

This study is part of a larger project in which a survey was used to analyze the role of information and communications technologies in the education of people with autism spectrum disorders during the COVID-19 pandemic. The focus was based on the experiences of relatives, caregivers, and autism specialists after a first semester of lockdown and remote learning. Due to pandemic restrictions, survey was conducted online, and it did not request any personal identifiers from the participants.

We adopted a qualitative approach to interpret the data, which was thematically analyzed.

B. Participants

Sampling was performed through an email invitation and by asking participants to pass along the survey link to other potential participants who met the criteria of being relatives or caregivers of people with autism, or autism specialists. From the initial 295 participants who took part in the global survey, we selected those who used video tools as a resource to support

remote learning during the pandemic. We ended up with 188 respondents, whose profiles included relatives and/or caregivers of people in the spectrum, teachers, non-teaching autism experts, and clinicians such as occupational therapists, speech therapists and psychologists (see demographic information in Table 1).

TABLE I. DEMOGRAPHIC CHARACTERISTICS OF THE PARTICIPANTS

Variable	Properties	N
Gender	Female	175
	Male	13
Age	20 - 26	7
	27 - 33	35
	34 - 40	46
	41 - 47	58
	48 - 54	22
	55 - 61	20
Profile	Teacher	99
	Relatives/caregiver	33
	Clinician	37
	Non-teaching autism expert	19
Location	Spain	180
	Latin America	8

C. Data collection and analysis

As a basis for data collection, individuals who had completed a course on assistive technologies taught by the researchers during the academic year prior to COVID-19 were invited to participate in the online survey, which included an explanation of the purpose of the study.

Open-ended questions were analyzed thematically [7] through a dynamic and inductive process to identify emerging themes. Stages followed included data coding, searching for themes, grouping them, and creating a report.

Researchers thoughtfully discussed the themes, and their consistency with the data was validated under a consensus to mitigate biases [8].

IV. RESULTS

Preliminary results provided us with insight into video conferencing tools used during the pandemic in inclusive learning and assistance for people on the spectrum. In Fig. 1 we can find the most used applications: Zoom, Whatsapp/Telegram, Skype, Jitsy Meet, Microsoft Teams, Google solutions and Webex. Google solutions refer to the Google Duo, Google Meet and Google Hangouts applications.

The experiences of all 188 participants regarding the accessibility limitations of the video tools used were organized into three themes: (i) complex UI, (ii) design for autonomy, and (iii) attention management.

The first theme, "complex UI", captures how difficult it was to manage the applications, not only by people with autism, but also by family members and autism experts who were participating in and supporting online learning. Some video conference tools are overly feature-rich, and sometimes their display may vary in the interface depending on a certain configuration. As one autism specialist explained: *"Different [user interface] configurations depending on the device used, sometimes lead to frustrating situations as the interlocutors are*

not seeing the same thing on the screen". Other consequence detected derived from this theme was the cognitive overload suffered by many people with autism during the video calls, due to the amount of information displayed on the screen (features and participants views).
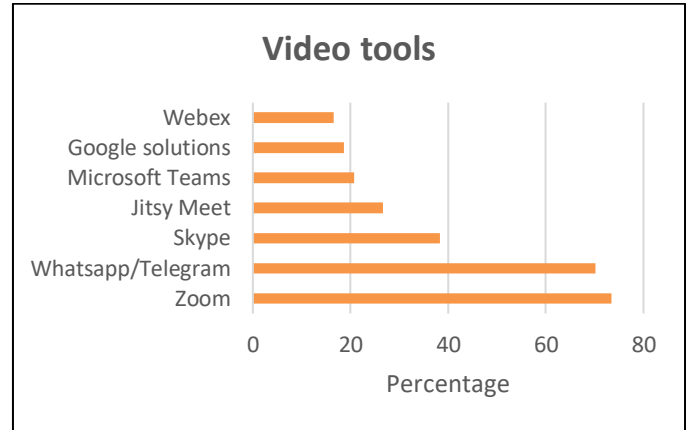

Figure 1. Most used video tools for special needs

The second emerging theme, "design for autonomy", reflects the low adaptation of video tools to the special needs and capacities of each person, in such a way that they allow their autonomous use. Software design should facilitate users the ability to decide, plan and act so that they can achieve their goals [9]. However, according to our results, family support and intervention in the use of video platforms was necessary since *"not all profiles [with special needs] have the ability to individually handle technologies"*, or because some students *"cannot respond a video call"*. This support was intensified in the case of young children who "*were totally dependent on the adult (mother/father/guardian) to connect the call*".

Participants reported several elements related to the third theme, "attention management". Autism specialists highlighted people on the spectrum struggled to focus on the video tool, so constant family supervision was required, though not always possible: *"I have only been able to establish communication with the students attentively enough to work independently with these technologies"*. They also commented the limitations of video interaction in special education compared to face-to-face, as there were no options to regain attention: *"It is difficult to reach students directly through this method"*, because they *"need an intervention and support that has not been possible through these means"*.

V. DISCUSSION

During COVID-19 pandemic, autism specialists used video conferencing platforms mainly for monitoring the learning process, which was developed delivering paper-based activities to relatives, but also for holding live lessons and conducting online work groups [10]. Interaction limitations of technology compared to face-to-face learning could be one of the factors that would explain why only 64% of the participants in our global study (188 of 295) decided to continue with special education assistance using video conferencing tools. Another important challenge in this inclusive online learning and assistance methodology was the digital divide [11]: Difficulty

in accessing technology due to lack of technical resources or digital knowledge by all parties.

Digital divide could also have had an impact on the "complex UI" theme. The abrupt shift to online learning meant that people had to gain proper access to IT resources and use unfamiliar video tools with almost no prior training. Even if they were aware of some of the platforms used, user interfaces and accessibility options, if any, vary from app to app, which can be confusing and even frustrating for people with cognitive disabilities. People with autism benefit from a structured/ comprehensive environment in which common patterns are followed, and a similar distribution of items is maintained whenever possible [12]. Since user interfaces offer different configuration options, sometimes depending on each device used, it is essential that a selected configuration could be persisted between sessions, or that it can be linked to a specific user. Likewise, video platforms should invest in creating simplified user interfaces, focused on increasing accessibility and reducing cognitive overload. The drastic increase in the use of these platforms since the pandemic has caused some cognitive exhaustion in most users, known in the popular media as 'zoom Fatigue' [13]. For people on the spectrum, there was not only visual exhaustion from increased screen time, but also an overwhelming feeling from the amount of information available on video calls, and from the number of eye contacts with people who appear to be at a lesser interpersonal distance than they would be in a face-to-face situation. This saturation can cause stress to the student, reducing their motivation and commitment to the online activity. Therefore, further improving immersive solutions that combine participants in a single virtual scene, removing distractors and reducing cognitive load, could be an interesting option.

Design strategies have an impact on the autonomy of the end user. "Design for autonomy" is a technological design in which every decision through the process supports the user's ability to make decisions, solve problems, set and achieve goals, that is, be self-determining [14]. However, many video conference tools are still not compatible with assistive technology as these platforms do not allow people with cognitive disabilities to use essential features.

Cognitive autonomy is a component of self-determination and it is essential to improve and maintain these skills not only to support education, but also life, learning and work. Technology is crucial to enable people with and without disabilities to live self-determined lives and, therefore, it should be cognitively accessible [15]. Video conferencing tools must offer options that allow people with cognitive disabilities to understand the functionality of the tool, either through the use of alternative text in the user interface, buttons with text, use of pictograms, or guiding the user with an audio assistant. In addition, the plurality in the design of this type of tools that are no longer aimed solely at an adult audience should be considered, given their new role in the paradigm of distance education derived from the pandemic: Their audience has increased to almost all ages and almost all special needs.

People with cognitive disabilities should be able to use video tools according to their own preferences and abilities, free from external influence of their family members as this dependency could cause them disappointment and irritation. It has been proven that when effective strategies are provided to support a comfortable use of video platforms for people with autism, they experience less stress and feel empowered to participate more in calls [16].

Regarding the third topic "attention management", we found that different factors may interrupt student's attention during a video call. This stimulus can come from their own environment or from the screen views of other participants. This difficulty concentrating on learning through a screen can worsen depending on the younger age of the student or the total number of participants in the videoconference.

During the learning process, people with autism require particular consideration as they commonly fail to keep sustained attention in class. In a face-to-face environment, teachers can track a student's behaviour and activity to infer their attentiveness level and act accordingly. However, this option become difficult through video calls, and even harder when there were multiple students simultaneously connected on the video platforms. Consequently, constant family supervision was very necessary, although it was not always possible.

Video tools could be improved by offering the host options to further interact with the video attendants and ideally to recover their attention through visual and/or sound stimuli. Likewise, attention through these means could be improved by reducing the cognitive load of its user interface. Fostering attention helps the learning process of people with cognitive disabilities by training their mental ability to convert multimedia information into rational concepts [17].

The multiple video platforms used along the pandemic, indicate that there was no consensus on which ones to select for inclusive education, and their choice could vary according to the preferences or needs of the autism specialist. This meant that both people with autism and their families had to learn to use many of them, coping with the changes in UI. Furthermore, these tools varied in complexity as in some cases they were part of a simpler messaging environment (e.g. WhatsApp), while in other cases they were part of a more complex learning environment (e.g. Microsoft Teams).

In terms of accessibility, recent studies indicate that Zoom, Teams, and Google Meet meet the highest accessibility standards, while Webex and Jitsy tie for last [18]. However, our results reveal a minor use of Teams and Google for learning by people with cognitive disabilities. Further research could be done to help uncover the specific problems this population face with these tools.

VI. CONCLUSIONS

As education shift towards a more and more hybrid paradigm as part of the new normal, there is a need for considering people with cognitive disabilities in this process. Video conference tools should meet design principles and approaches to make them more inclusive and accessible to all students, regardless of their functional capacity. This study explores the video tools accessibility limitations by which people with autism could not benefit enough from remote

inclusive learning along the pandemic: complex UI, design for autonomy, and attention management. These themes highlight the importance of interface design for user acceptance, for their self- realizing abilities without external influence in their decision-making process, and for improving attention to the tool. We also provide a list of the most widely used video conferencing tools for learning for people with autism throughout COVID-19: Zoom, Whatsapp/Telegram, Skype, Jitsy Meet, Microsoft Teams, Google solutions, and Webex.

This study helps fill the gap regarding the accessibility requirements of people with cognitive disabilities while using video platforms for remote learning. It is essential to address these limitations to meet the expectations and needs of people with disabilities in the new online learning environment.

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