

Accessibility Evaluation of Video Conferencing Tools to Support Disabled People in Distance Teaching, Meetings and other Activities

Marion Hersh¹, Barbara Leporini² and Marina Buzzi³

¹ Biomedical Engineering, University of Glasgow, Glasgow G12 8LT, Scotland, marion.hersh@glasgow.ac.uk

² ISTI – CNR, Via G. Moruzzi, 1, 56124 – Pisa, Italy, barbara.leporini@isti.cnr.it

³ IIT – CNR, Via G. Moruzzi, 1, 56124 – Pisa, Italy, marina.buzzi@iit.cnr.it

Abstract. The current covid-19 pandemic has transferred educational, work and other activities on-line and made it essential to be able to use videoconferencing tools. This raises many issues for disabled people, including the accessibility and usability of these tools. However, studies evaluating accessibility and usability of these tools seem to be lacking and this paper contributes to filling this gap. It has three main contributions: (i) the presentation of criteria to be used in this valuation; (ii) a preliminary study of the experiences of the two disabled authors; (iii) preliminary recommendations for tool developers.

Keywords: video conferencing tools; distance teaching; distance meeting; disabled people; accessibility

1 Introduction

A wide range of technology has been in use for a number of years to support learning and teaching. Phone and video conferencing were already being used for meetings to a limited extent, both for convenience and in response to global climate change. Some conferences offered distance presentation options. However, the mandatory physical distancing introduced by the COVID-19 pandemic forced the majority of activities to move on-line, at least on a temporary basis.

Learning and teaching, work, meetings, social and leisure activities all moved on-line, often at minimal, if any, notice, giving little or no time to prepare. In the case of education the focus was generally on using technology to present classes and lectures using videoconferencing technologies, often lacking the time to consider the underlying pedagogical issues and the full potential of the technology. Previously Skype was probably the best known and most commonly used tool, whereas now many other tools are being used, including Zoom, MS Teams, Jit.si, and Google Meet.

This raises a number of issues for disabled people. These include their access to all necessary hardware, including any relevant assistive technologies, at home, the ability to download any necessary software, access to any required assistance and the accessibility and usability of the tools and all their functions. Where free versions do not provide the full functionality and workplace, or other organisational subscriptions are not available, there is also the issue of being able to afford account/subscription costs. This paper will focus on the accessibility and usability of video conferencing tools. To the best knowledge of the authors, there are no full studies of the accessibility and usability of these tools for disabled people.

The paper contributes to filling this gap. It has three main contributions: (i) the presentation of tools which can be used to evaluate the accessibility and usability of online presentation and video conferencing tools for disabled (and non-disabled) people; (ii) a preliminary small scale study of user experiences with these tools; and (iii) preliminary recommendations for tool developers. It has a particular focus on the educational context since in this area tools and experiences are more generally relevant.

The paper is organized into 6 sections. Section 2 briefly overviews the relevant literature and section 3 presents the methodology. Section 4 presents the criteria and section 5 the results. The concluding section, 6, discusses the results, provides preliminary recommendations and suggestions for future work.

2 Related Work

There is a wide range of tools to support on-line learning, including video and video-streaming, screen and resource sharing, quizzes, polling, video chat, survey, to favour students engagement, as well as videoconferencing tools, which themselves have a number of features. Research suggests that student satisfaction increases with an increased level of interaction in on-line conferencing systems [1]

The following discussion considers the literature on the accessibility of videoconferencing tools, videos, video chats, screen sharing, and video streaming sessions. In the last few years, videos have been increasingly used as an educational tool, in science, schools, work, and personal study. However, people with single or dual vision or hearing impairments or processing impairments experience barriers to accessing audiovisual materials. In addition, while many autistic people appreciate audiovisual materials, some of them find the dual-channel impossible to deal with.

Both blind and deaf people can use subtitles but the frequently poor quality education of hearing-impaired people, as well as the fact that for deaf signers the subtitles are in a foreign language, may mean they experience difficulties in understanding long or low-frequency words. Deaf signers prefer a sign language version. However, the use of edited versions of subtitles is controversial [2]. An Accessibility Adaptor that translates video subtitles of videos to SignWriting has been tested by the Worldwide Web Accessibility Initiative [3]. However, Signwriting, which is a written graphical representation of sign language, is used by a few Deaf people, so not very

useful. Audio descriptions of the video can be used by blind people, but are rarely available.

Learning Management Systems, such as Moodle, provides a number of options to access online learning resources and engage in activities, such as quizzes. Studies of their accessibility include [4]. There are also early studies of making e-learning courses accessible to disabled students and teachers with disabilities [5].

An investigation of the usability and accessibility of six popular video call Android applications including Skype, WeChat, Hangouts, Tango, Line and Viber found that none of them was fully accessible for blind people [6]. The accessibility of the Web conferencing tool Adobe Acrobat Connect system has been investigated [6] and the results show that a fair degree of keyboard accessibility is not sufficient for an effective interaction by keyboard and screen reader users.

The International Foundation for Electoral Systems (IFES) has suggested guidelines and good practices for employers for conducting accessible virtual meetings. This includes providing all materials in accessible formats in advance, participants identifying themselves before speaking and speaking clearly and slowly and using live transcription or captioning. A comparative evaluation of Skype (v.8 and Business), MS Teams, Zoom and GoToMeeting based on 10 criteria found that none of them met all the criteria [8].

3 Methodology

In an educational context, considerably more attention has generally been given to the accessibility and other needs of disabled learners than disabled teachers. This makes it particularly important to consider teachers' accessibility requirements. When teaching through videoconferencing, the teacher has the role of meeting host, as well as participant and therefore needs to be able to carry out all the additional activities required of the meeting host as well as to participate in the meeting. Some tools require hosts, but not participants to log in and to set up an account if not using an organizational one, whereas other tools, particularly Skype, require everyone to set up an account and log in.

The criteria to be considered in evaluating the accessibility and usability of the different tools have been obtained through a functional analysis involving consideration of the various activities required to both participate in and host a meeting. These key functions were used to draw up an initial list of criteria, which will be developed and expanded in subsequent work.

A preliminary study of a number of different videoconferencing tools was carried out by the two disabled authors. This is based on an analysis of the tools they have already used both for teaching and in meetings, including Google Meet, Jit.si, Microsoft Teams, Skype, Skype for business and Zoom. Most of these tools offer different versions, including web based, apps for PCs and and mobile app-based versions (for Android and IOS operating systems) and in some cases there is the option of phone dial in, but without many of the functions.

The current evaluation is of the web and PC app versions of the tools with phone dialin. The authors plan to carry out an indepth study of web, PC and mobile applications and involving a number of disabled teachers.

4 Criteria

This section presents the criteria used in the accessibility evaluation. They have been defined on the basis of the main tool functions offered to the user.

4.1 Tool features

Video conference tools such as Skype, Meet and Zoom provide functions for two main roles: (a) host, who creates and manages the video conference (e.g., teacher or group leader); (b) participant, who takes part in a distance lesson or a remote meeting (e.g. student, research partner, group member). Therefore, the following tool functions should be accessible: (I) Joining and participating in a meeting, (II) Hosting (organising) a meeting, (III) Chairing or facilitating a meeting, (IV) Participating, including turning on and off audio and Video; (V) Support for assistance and communication with assistants; (VI) Advanced options; (VII) Setting up and managing an account (if required).

Table 1: List of features offered by the video conferencing tools

I	<i>Joining and participating in a meeting</i>
	Participating without requiring an account Signing in, if necessary Connecting to the meeting Option of audio-only or audiovisual when you use the link Using meeting tools to indicate you want to speak Hearing other participants Speaking and being heard by other participants Using chat
II	<i>Using audio and Video</i>
	Using system tools to mute and unmute your microphone Using system tools to adjust microphone volume Quality of sound Turning video on and off Zooming video in and out Quality of video
III	<i>Hosting a meeting</i>
	Logging in Setting up a meeting Setting up a meeting with cohost(s) Inviting participants to join

	Admitting participants
IV	<i>Chairing a meeting</i>
	Awareness of participant indications they want to speak using meeting tools Awareness of participant indications they want to speak using the chat Awareness of phone participant indications they want to speak Inviting participants to speak Controlling whether or not the meeting is recorded.
V	<i>Support for assistance and communication with assistants</i>
	Host liaison with cohost e.g. about admitting participants showing powerpoint or other videos for a participant using audio only Support for interaction with another participant Support for captioning Support for sign language interpretation
VI	<i>Advanced options</i>
	Using meeting tools to set up small group discussion in 'breakout' rooms Participating in small group discussions Reporting back to the main meeting
VII	<i>Managing an account</i>
	Other

4.2 Evaluation criteria

These functions can be used as the basis of the accessibility evaluation criteria. Many of the functions are required by all meeting participants, whereas some are only used by meeting hosts. The preliminary evaluation is based on a subset of the above functions since there are a considerable number of them. The results are based on the experiences of the two disabled authors of this paper in using these videoconferencing tools from home in teaching and work related and other meetings during the Covid-19 lockdown period. One of them accessed the tools with the Jaws screen reader and the other used phone dial in.

5 Results

Due to space limitations the following discussion summarises the authors' overall experiences with the different tools based on the criteria rather than provide details of performance for each of the criteria. The authors are only aware of a phone dial in option being available for Jit.si, MS Teams and Zoom. To retain a degree of anonymity while separating out the different experiences the authors will be referred to as SR (screen reader user), ASO (author needing to avoid sensory overstimulation) and ND (non-disabled). SR uses a JAWS screen reader and ASO generally uses the internet with colours and graphics turned off.

Google Meet

SR found Google Meet relatively easy to use via Jaws screen reader, but was unable to access the shared content. However, they were disappointed at the lack of a 'Raise hand' function to indicate you want to speak and enable the chair to see the order in which people raised their hands. They noted the host does not have the option of muting all speakers. They appreciated the shortcuts for microphone and videocamera, but considered that some additional shortcuts were required to enhance the interaction.

Jit.si

ASO has both used successfully it and been unable to dial in. They originally thought that the problem was lack of the correct meeting ID, but now think that the meeting may not have been set up to allow phone dial in. This was probably due to inexperienced meeting hosts not knowing how to set up meetings for phone dial in and implies that clearer information is required on the site. Call quality was good on the one occasion they managed to dial in, but they were unable to use the meeting functions from a phone. SR was able to use this tool, but experienced difficulties with the button labels, as they did not provide feedback on their status (e.g. microphone muted or unmuted). They also found that many functions were inaccessible.

MS Teams

SR found interaction with MS Teams quite complex and experienced difficulties in orientation within the user interface. However they found the file sharing option very useful for giving them access to slide content in powerpoint format. The terms shortcuts were more useful in theory than practice, as difficult to remember. ASO has used MS Teams quite frequently to participate in meetings. They have used the phone dial in option quite successfully, though sometimes difficulties were experienced in entering the meeting ID or password, including through insufficient time being allowed. They have found call quality very variable. In particular, sometimes the sound from other participants has broken up or been lost briefly. Further problems including participants being exited from the meeting for no reason and having to dial or link in again. ASO is unable to access the chat and is unaware of phone options for accessing meeting tools other than un/muting. They have been unable to unmute when the meeting host has muting everyone and this is apparently a well-known problem with MS Teams.

Skype

Both SR and ASO have found that inaccessibility has increased with version 8 and above and regret that older versions cannot be used. SR is able to make and answer audio and video calls, but finds the process difficult and lengthy, as it requires a lot of steps using Tab. ASO used to be able to use Skype and was able to turn the video input off and adjust microphone volume, but did not find it particularly accessible and was unable to use the chat. They also noted that calls involving multiple people could take a long time to set up. They now avoid it. ND has noted that an older friend experienced considerable difficulties in learning to log in to Skype, set up a call and add people to it. ASO has noticed that people of all ages can experience difficulties in adding people to Skype calls.

Skype for Business

This has now been replaced by MS Teams and is not missed. SR has found many of the hosting features are inaccessible. No dial in option is available. ASO was able to use the link and to hear participants but could not join in the discussion, as no tools were visible (presumably due to being indicated purely graphically) and the default option was microphone muting.

Zoom

ASO has used Zoom both for teaching and for meetings. The site presents too much visual disturbance to enable them to log in and act as a host. They, therefore, use the phone dial in and have successfully used the mute/unmute phone tool. Their negative experiences with Zoom and Skype for Business links have discouraged them from using other links. They have become aware of phone options for indicating they want to speak and meeting host functions, but have not tried them. They have experienced difficulties when waiting for a host to admit them to a meeting due to musak, though muting the speaker and wearing ear defenders reduces the problem. They have asked for black and white powerpoint slides to be sent in advance to enable them to print them out since they do not have access. When lecturing a teaching assistant has set up the meeting and shown the powerpoint slides. SR has used zoom both as participant and meeting coordinator. They consider many of the tool features accessible, but have experienced great difficulties with content sharing of other people's presentations, but not with sharing their own presentation. The large number of buttons on the user interface means numerous keyboard steps are required unless shortcuts. ND has observed that hovering the mouse to show the menu was not intuitive for older inexperienced users.

6 Conclusions

The paper has discussed the evaluation of the web-based versions of a number of different videoconferencing tools. This included the development of a number of evaluation criteria. A preliminary evaluation was carried out by the two disabled authors, with support from the non-disabled author in checking and testing the tools. The results showed that none of the tools was fully accessible to screen reader users or users with graphics and colours turned off or using phone dial in. A particular problem for screen reader users was found to be content sharing, as video content was only available in graphical form which is inaccessible via screen readers. However, MS Teams provides file-sharing options which support screen reader access, as long as the file itself is screen-reader accessible and, for instance, provides alt descriptions of graphics. File sharing options would also enable files to be printed out.

As far as the authors are aware only Jit.si, MS Teams and Zoom provide phone access. This is required for accessibility for some disabled people. However, not all meetings using these tools provide phone dial in, probably due to inexperienced hosts not being aware of the option or need. None of these tools provides phone access to

the chat or all tool functions. Documents need to be shared in advance (which can be advantageous to some disabled people) or with the assistance of a support person. Several of the tools provide options to turn off or not receive video input. However, the tools are designed to use video and consequently disabled people who use audio only are likely to have a poorer experience. The ability to set up and host meetings and show presentations during them is important for teaching and other workplace activities. All the tools performed poorly in this area.

The authors are planning to develop and extend the criteria and apply them in a large scale study of experiences disabled people with diverse impairments and other characteristics of using videoconferencing tools. The study will cover web based and PC and mobile app versions of the tools to allow comparisons. The evaluation will have both quantitative and qualitative elements and the results will be used to develop more details recommendations for tool developers and users.

Preliminary recommendations include: (i) the provision of file-sharing or other options to provide access to screen shared content for screen reader users; (ii) phone dial in access with options for accessing the system tools; (iii) the tool home and other pages should meet web accessibility guidelines, including text versions of all links and following user specifications for colour, graphics etc.

References

1. Kuo, Y. C., Kuo, Y. T., & Walker, A. (2010, May). The effect of student interactions and Internet self-efficacy on satisfaction in two synchronous Interwise course sessions. In *Global Learn* (pp. 4242-4246). Association for the Advancement of Computing in Education (AACE).
2. M.A. Hersh (2013). Subtitles and the Representation of Emotions and Contextual Features: A Two-Country Survey of Deaf People's Experiences, Attitudes and Requirements, *Telecommunications Journal of Australia*, vol. 63(2), pp. 23.1-23.14.
3. Pérez, E. V., Sánchez, M., & Crespo, R. G. (2017). A System to Generate SignWriting for Video Tracks Enhancing Accessibility of Deaf People. *International Journal of Interactive Multimedia & Artificial Intelligence*, 4(6).
4. M.A. Hersh (2008). Accessibility and usability of virtual learning environments, 8th IEEE International Conference on Advanced Learning Technologies Santander, Spain.
5. Burgstahler, S., Corrigan, B., & McCarter, J. (2004). Making distance learning courses accessible to students and instructors with disabilities: A case study. *The Internet and higher education*, 7(3), 233-246.
6. Maneesaeng, N., Punyabukkana, P., & Suchato, A. (2016). Accessible video-call application on android for the blind. *Lecture Notes on Software Engineering*, 4(2), 95.
7. Benda, P., Havránek, M., Lohr, V., & Havlicek, Z. (2010). Possibilities of web-conferencing systems for disabled students. *AGRIS on-line Papers in Economics and Informatics*, 2(665-2016-44841), 81-86.
8. IFES, Guide, Inclusion Insights: Holding Accessible and Inclusive Virtual Meetings, 2020, https://www.cfgr.org/wpcontent/uploads/2020/05/inclusion_insights_holding_accessible_and_inclusive_virtual_meetings.pdf.