Usability of Digital Information and Technology with People with IDD

BARRY ISAACS, LISA COHEN, PETER COPPIN, CAROLYN ELIAS, SANDRA LAW, AND JUDY VERSEGHY

OCAD UNIVERSITY

@SurreyPlaceON

SURREY PLACE

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1.0 Purpose

While the 2019 Accessible Canada Act lays out steps to remove barriers to access for Canadians living with disabilities, little consideration has been given to the specific usability needs of people with intellectual and developmental disabilities (IDD). In the case of digital information and information technology, this gap remains unaddressed and results in a variety of inequities for people with IDD, furthering the exclusion of a portion of the disability population. While there are examples of information and communication technology (ICT) that attempt to address accessibility needs for people with IDD, current standards and guideline are inadequate to guide developers of information technology and information that is shared through such technology. As a result, usability barriers prevent this population from accessing and participating freely in what is increasingly becoming the "digital world". Studying usability as a barrier for this population is a key piece of the narrative that has been missing from accessibility discussions.

In the part of this project, we completed a literature review that identified seven barriers faced by people with IDD when interacting with ICT and digital information:

- The reliance on text-based content to convey information or interact with technology i.e., the need to read text to get information or input text to interact with ICT.
- Complex security features e.g., password requirements, or the need to receive and enter codes to gain access to application (two factor authentication)
- Complexity of information due to 1) large amounts of text in long paragraphs, often requiring high levels of literacy to understand, 2) the use of jargon and other unusual words, and 3) highly detailed visual displays.
- Unfamiliar technology when changing hardware or upgrading software.
- Need for manual dexterity often required to operate hardware such as a keyboard or stylus.
- Lack of training and technical supports.
- Task complexity such as keyboards buttons with multiple function and/or tasks that required multiple steps.

In this second phase we consulted with a group people with IDD and those who support them to:

1. Confirm if they, themselves, experienced the barriers identified in the literature review.
2. Explore and further describe the identified barriers.
3. Identify additional barriers (if any) not accounted for in the literature review.
4. Explore solutions to overcoming the barriers to accessing ICT and digital information.

2.0 Participants

A total of eight (8) people acted as advisors to this project. Six of the advisors have IDD and two (2) do not. Advisors were recruited through three organizations that provide services to people with IDD (Surrey Place, the Centre for Addiction and Mental Health and Community Living Toronto) and one national organization (Inclusion Canada). Five of the advisors with IDD were from Ontario and one was from Newfoundland. The advisors with IDD ages ranged from 12-64 years. All advisors with IDD functioned in the mild range of disability. Both advisors without IDD lived in Ontario. One was the father of an advisor with IDD and the other the husband of another advisor with IDD. In other words, two of the advisors with IDD have support people participating in the project along with them and those support people are also acting as project advisors. All project advisors were paid $400 for their work on this project.

3.0 Methodology

To date we have had 3 sets of meetings with each advisor with and without IDD. If an advisor with IDD had a supporter (advisory without IDD) taking part in the project, we usually met with them both together. On most occasions we met with advisors without IDD who did not have a support person involved in the project individually. On one occasion we used a focus group format to meet with advisors with some project advisors. To date a total of 15 meetings with project advisors have been held. Meetings consisted of semi-structured interviews and ICT related tasks (See Table 1 for details).

Table 1: Summary of meetings with advisors

	Meeting purpose	*Meeting structure*
Meeting 1	Nature of ICT use and barriers	6 meetings (4 with advisors participating independently, 2 with advisors participating jointly)

Meeting 2	Detailed exploration of barriers	4 meetings - 1 focus group (including 3 advisors with IDD and 1 without), 2 individual meeting with an advisor participating independently, 1 meeting with an advisor pair with and without IDD
Meeting 3	• Website navigation tasks • Testing of existing accessibility features • Discussions of solutions	5 meetings - (4 with advisors participating independently, 1 with advisors participating jointly)

All meetings were recorded, with the consent of advisors, and then transcribed. The transcripts were inputted onto Dedoose©[1] where data was analyzed using inductive coding. The analysis began with broader codes (referred to as parent codes) then became more specific (referred to as child codes). Microsoft Excel and Word were used to organize the codes and excerpts, in which the excerpts substantiate the codes.

4.0 Results

4.1 First Round of Interviews

The first round of interviews focused on how advisors used ICT and the barriers they have encountered. The most common devices owned and used by advisors were smartphones, laptops, and tablets. Their activities include banking, communication (e.g., virtual video calls, social media, or email), education, work, information seeking, ordering prepared food (takeout), shopping, navigation, and virtual appointments.

A number of challenges were identified. Advisors often described situations in which one type of challenge led to further difficulties and negative consequences. These are described below.

Advisors provided many examples of websites that were difficult to navigate and to perform everyday functions. Online banking was one specific area of difficulty. The inability to perform certain functions resulted in further challenges and negative outcomes. Again, in banking the inability to set up and utilize two-factor authentication led to increased fears

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[1] Dedoose is a qualitative and mixed method analyzing software.

of being a victim of security breaches. Difficulties of making a payment also leads to credit difficulties. One participant no longer had a credit card because she tried but could not figure out how to make payments online.

> *"It was hard to make the payment because I didn't know where to*
> *put the payment in on the computer"* (P1).

Online shopping was another area in which the complexity of websites was a barrier to their use. Specific problems identified were understanding the quality and quantity of an items one wished to purchase. None of the advisors with IDD shopped online because this lack of understanding led to fears of making a mistake (e.g., buying too much of an item, buying the wrong item or spending more than one can afford). Advisors also discussed safety and security as a reason for not shopping online.

Other difficulties resulting from complex ICT interfaces included problems with:

- Filling out forms.
- Printing.
- Formatting or manipulating objects.
- Understanding information (particularly text).
- Dealing with changes in a software interfaces dues to updates.
- Operating new hardware, for example one participant had recently moved to a new school requiring a change of laptop that the school provided. She could not adjust to the new laptop so just used her personal computer.

Advisors use various types of assistive technology, including large keyboards, screen readers, voice-controlled devices, or word predicting software. Assistive technology was described as helpful but also it can present its own challenges. There were instances discussed by two advisors where mispronunciation or repeating oneself led to problems with voice activated assistants.

> *"And some words when I try to spell them, it don't pick it up because*
> *I can't really pronounce it and my phone don't pick it up...Siri or the*
> *screen reader"* (P3)

One of the advisors expressed that their hearing loss makes text-to-speech aids difficult to hear. Many advisors acknowledged the need to engage with others for support. This

support could come from a family member, friends or a professional they rely on for general support such as a developmental support worker or teacher.

Despite these challenges, most advisors described some degree of digital autonomy and there are aspects of using ICT that they do well:

- Logging into or entering passwords independently to access accounts e.g., E-mail).
- Composing emails or writing letters in Word Doc or Google Docs.
- Switching from one software to another on a familiar device (e.g., phone call to text to email).

4.2 Second Round of Interviews

The second phase of interviews aimed to identify and further explore the most common challenges and barriers to accessing ICT experienced by the project advisors and further understand the underlying causes of the challenges. The most prevalent barriers and challenges are listed along with their causes below. Most causes were self-identified by the advisors. Some causes we inferred based on characteristics that must be present for a person to receive an IDD diagnosis, such as poor information processing.

Searching for information

Advisors discussed difficulty conducting searches using online tools such as Google. Causes:

- Difficulty identifying the proper search terms.
- Difficulty inputting search terms correctly (e.g., not being able to spell or pronounce words correctly when using speech to text aids).

Changes to software/hardware

Changing from the type of hardware (e.g., getting a new phone or laptop) or software (e.g., updating to a new version of commonly used software) to another was a common challenge. Useful interfaces were changed (e.g., fingerprint may be replaced by face recognition, or general looks and layout may be quite different from one version of a software to another). Additionally, the process of transferring information from an old device to a new one was complex. Causes:

- Learning difficulties make adjusting to new format and layouts a challenge.
- Processing difficulties make following the multi-step instructions for transferring information a challenge.

Being afraid to make a mistake

Advisors experienced lack of comfort or confidence with certain online activities because of the fear of making a mistake (e.g., buying the wrong quantity) or security concerns (e.g., fraud). Causes:

- Previous negative experiences.
- Concerns about being victimized.
- Recognizing they don't understand how to perform certain functions online.

Too much information, usually in text content. In addition, text is sometimes too small

Advisors identified many websites that they found challenging because of reliance on text. Causes:

- Reading level of most people with IDD is at an elementary school level.

Challenges with multiple tabs and drop down-menus

Advisors found the layout of different websites difficult, especially when there were multiple tabs or drop-down menus. On advisor described it this way.

> That does make it difficult to read because you got so much information or multiple tabs, and with one so you click this, click that and then brings the next page. Then you can go back to another page. Then you go to the next page and go back and [exit] that and go back, why can't you have it all. (P3)

Causes:

- Difficulties processing complex information, memory and performing complex tasks.
- Difficulties reading.

Updating software, and inability to update due to technical issues.

Advisors identified several difficulties with updating software. Sometimes the difficulty was the sudden appearance of a message to update. There was a preference for the auto updates over the manual updates as the manual updates may interfere with what they are doing on their ICT devices. There were times that advisors experienced not being able to update their devices because their device or software was out of date, or an error code

appeared on their screen. When error codes showed up advisor indicated they would search for information on it but often the extra step to find information about the code increased the difficulty, and if they could not find it, they ignored the message.

Causes:

- Difficulties processing new information.

4.3 Third Round of Interviews

The third phase of interviews we:

- Attempted to observe some of the challenges identified by advisors in accessing ICT and digital information by watching them interact with specific websites and perform an internet search.
- Observed how advisors use accessibility aids, to understand information, navigate websites and perform searches.
- We also asked advisors to give us feedback on the experiences with accessibility aids.

Most advisors regularly use voice-recognition software (e.g., Siri or Google Dictate) because they have difficulty spelling and writing sentences or phrases. A common challenge with this type of aid is mispronunciation. It was suggested by one advisor that voice-controlled devices should consider how people with IDD speak. Other accessibility aids used by advisors include:

- Specialized keyboards.
- Screen readers (e.g., Q Reader).
- Online writing assistant (e.g., Grammarly).
- Text-to-speech.

Observations on website interactions

We asked advisors to view and interact with the website for our organization www.surreyplace.ca. Initially they viewed it as helpful based on the presentation, particularly the homepage layout. After further investigation, however, we noticed that many advisors did not use the drop-down menus when asked to find information about certain topics (e.g., services or about the organization). Rather, they utilized an alternative

way to find desired information. For example, using Google search and inputting "Surrey Place History" or using the site search feature.

Many advisors were not able to find information because tab headings were too abstract, e.g., job were under a tab labelled "Get Involved". Advisors agreed that it would be helpful if they could hover over word to have a definition appear or be read out loud to them.

Advisors had similar difficulties with two job search websites https://ca.indeed.com/ and https://www.jobbank.gc.ca/home:

- They had trouble understanding certain terminology (e.g., the word "remote").
- The layout or the search option provided on the homepage was confusing.
- Reliance on manual entry to conduct job searches was challenging.
- Although icons were used, limiting text, it was not clear to advisors what the icons meant.

Suggestions provided by advisors of how to improve these sites included:

- Less text.
- Pages less densely packed with information.
- Plain language (e.g., instead of using the word "remote" use "work from home").
- Definitions of certain words (e.g., jargon or high-level terminology) provided.

Use of Accessibility Features

The Surrey Place website offers a range of accessibility features. It was not immediately apparent to the advisors, however, that these were available. The dictionary, contrast, text resizing, hide images, and screen reader, were common features that advisors viewed as beneficial. The screen reader, however, did not always work as intended and also the spelling of words was read at a fast speed. Furthermore, to improve the website overall, advisors suggested increasing the use of plain language and making the accessibility features more prominent or immediately available. Advisors agreed that having a site map with links or a text-based list of what is on the site would be useful for navigation.

Web Searching

Advisors participated in a search task. The majority were able to complete a search successfully. For two advisors having a voice-controlled device was beneficial for times when they spelt words incorrectly. One advisor stated that if they spell words incorrectly and their search results are inaccurate, they will ultimately give up searching.

5.0 Discussion

The meeting with project advisors confirmed and provided additional insights into the findings of the literature review. People with developmental disabilities have some degree of digital autonomy. They regularly use ICT and access digital information. Their use of ICT and the benefits they experience are hampered by accessibility issues.   The following characteristic of ICT and digital information contributing to barriers in accessibility for people with IDD are:

- The reliance on text-based content.
- The need to perform complex functions e.g.
    - Two factor authentication and other security feature
    - Multiples steps for updates or printing
- Complex layouts e.g.
    - The use of jargon and other unusual words and complex grammar
    - multiple tabs.
- Changes in hardware or software e.g.
    - Changes in interfaces after updates.
- Need for manual dexterity often required to operate hardware such as a keyboard or stylus.

Current accessibility tools are not always helpful in enabling them to overcome barriers for example screen readers do not always work well or speech-to-text is difficult to use for those who cannot always pronounce words correctly.

The information from the literature review and consultations were used to develop recommendations and create decision tree to specifically address the needs of people with IDD (see Appendix B). The decision tree acts as a catalogue of solutions drawn from the

WCAG 2.1 guidelines and identified areas where no guidelines or solutions exist. A visual of the decision tree is attached in a separate document. We must caution that even where WCAG guidelines exist they may not necessarily address the needs of people with IDD. These concerns are reflected in the recommendations.

6.0 Recommendations

1.Current WCAG guidelines need to specifically consider the needs of people with IDD

Current WCAG guidelines are designed to address barriers faced by people with cognitive disabilities. Cognitive disability, however, is a broad category and the unique and specific needs of people with IDD remain unaddressed in guidelines. Current guidelines do not clearly address the fact that people with IDD often have multiple disabilities, nor are they written in a way that is accessible to people IDD.

1. Assess the degree to which current guidelines and success criteria address the needs of people with IDD. Give priority to guidelines listed in Appendix A that align with barriers faced by people with IDD.

2. Include people with IDD and those who support them on technical committees. When doing so ensure they are supported such that their participation is meaningful. Consult with experts in IDD when trying to accommodate people with IDD and promote their meaningful participation.

3. Consider the way standards can address the issue of intersectionality where people have multiple disabilities.

4. Create accessible versions of guidelines and standards so people with IDD can be more involved in the process of development and evaluation.

2. Development of guidelines on development and updating of hardware and software technology

WCAG guidelines focus on building accessible web content, but do not address barriers created by hardware and software. Features such as hard to locate or use on/off switches, complex or difficult to use keyboards, major changes in interfaces when hardware or software are updated.

1. Develop guidelines on the development of hardware, including smartphones, tablets, laptops, desktops, printers and scanners that address barriers to their use by people with IDD.

2. Develop guides on software updates to address user issues created through major changes in user interface. For example, develop guidelines for entities to incorporate accessible sitemaps and user instruction utilizing simple language, paired visuals and structured task analysis lists to support learning related to ongoing updates and changes.

3.Promote and support research using UX and Co-design approaches to address gaps in accessibility solutions when it comes to barriers people with IDD face in accessing ICT and digital information

Many solutions exist to help people with IDD overcome the barriers to using ICT and accessing digital information. Many existing solutions, however, are not developed with the specific needs of people with IDD in mind and are difficult for them to use and/or are ineffective. For some barriers no solutions exist. A major contributor to this problem is that research on accessibility to ICT and digital information for people with IDD is lacking both in quantity and quality. In what little research exists, co-design and UX approaches are rarely employed.

1. Identify needs and priorities by:
    - Reviewing the list of solutions and gaps identified in Appendix B with a broad range of stakeholders with IDD and those who support them.
    - Funding large scale needs assessments that include and is guided by people with IDD (including those with multiple disabilities) as equals in the research process.
2. Promote and support research that test the effectiveness of existing solutions with people with IDD (including those with multiple disabilities) using UX approaches.
3. Promote and support development of new solutions using Co-design.

7.0 Appendix A

7.1 Questions for First Interview

Questions for User

1. Can you tell us a bit about your yourself?
    a. Do you have any specific sensory difficulties? (e.g., seeing or hearing)
        i. Do you have something to help you with those (e.g. glasses or a hearing aid)
    b. Do you have difficulties using your hands or fingers to hold, move or touch things?
2. Are you familiar with Information and Communication Technology (ICT), such as computers and smart phones? Do you use ICT?
3. Do you have access to the internet (Wi Fi or data plan)?
4. Is your access limited for any reason?
5. What do you use ICT for?
    a. Entertainment (YouTube, Netflix, etc.)
    b. Recreation and Social
    c. Communication (Email, social media)
    d. Go to websites to look for information
    e. Daily living reminders
    f. Online banking
    g. Online shopping
    h. Health and safety
    i. Online medical and mental health
    j. Appointment reminders
    k. Online food orders (groceries or Skip/UberEATS)
    l. Program registrations
    m. Job searching and applications
    n. At work, school, vocational or day program
6. What works well? What are you really good at when it comes to using a computer smartphone or tablet?
7. What do you find difficult about it?
8. Do you use any tools that help you use your computer, smartphone or tablet? For example, screen readers, Dragon software, large keyboards, etc
9. Is there anyone that helps you when you need it? How do they help you?
10. Are there things about using computers, smartphones or tablets that you need help with but are not getting?

Question for Supporters

1. How do you support (name of person with IDD) to use IT?
2. What works well?
3. What do you find difficult about it?
4. Is there something you need that would help you support (name of person with IDD) better to use IT?
5. What might help (name of person with IDD) be more independent when using IT?

7.2 Questions for Second Interview

1. Challenges of Design/Layout
- Multiple tabs within one website
- Too much information
- Too much text can/not enough graphic make it difficult to understand information
- Format (e.g., bullet points)

2. Complexity of Tasks
- Example: answering or declining a call while on the phone, or setup of the built-in version of a software (e.g., Zoom) or extension.
- How to make an online payment
- Complicated toolbars

3. Challenges Searching
- The information one is trying to find is not showing up/finding the right key words
- Difficulty entering keywords because of spelling errors
- Mispronunciation when using speech-to-text

4.Getting Blocked out of an Account
- Difficulty entering a code that is sent to your email or phone that you need to enter onto a website (often called authenticator). Example of website: online banking or social media account.
- Not understanding why you can't access your account

5. Challenges with Assistive and Accessible Technology
- Screen Readers (text-to-speech)
- Voice Controlled Devices (speech-to-text)
- Captions

6.Difficulties with Updating Software
- Auto-updates or manual updates – what are the challenges found?
- Updates don't go as planned

7.Difficulties with Installing Software
- Steps are not clear or too complex – e.g., some people find installing from CD easier than downloading from internet because the steps are more straight forward.
- Install does not complete/go as planned

8. Challenges with the Change of Hardware or Software
- New phone, laptop or tablet
- Switching to a different software - e.g., desktop apps to online version of software – MS Word to Google docs

9. Troubleshoot – What do you do when…
- When a device or digital platform freezes,
- WIFI won't connect,
- Hardware won't connect (for example: headphones or camera),
- Download won't occur or is incomplete

10.Does Lack of Comfort or Confidence with ICT limit your use? Example:
- A fear of making a mistake in online activities (e.g., buying the wrong things or quantity when shopping)
- Concerns over online security (e.g., viruses or fraud)
- Not using ICT because it is too difficult/frustrating

7.3 Questions for Third Interview

1. Do you use a screen reader? Do you use any other accessibility aids (e.g., speech-to-text, special keyboard, text-to-speech, accessibility feature in google).
   a. What do you use them for?
   b. How do they work? What works well and what are the issues?
   c. What would improve them?

Website:

Surrey Place Website: https://www.surreyplace.ca/

1. This is the Surrey Place website; we want to get your thoughts on it. If you were looking for information on Surrey Place, do you think this website would be helpful to you? Why or why not?
   a. If you wanted to find out more about the organization, Surrey Place, would you find this website helpful?
   b. If you wanted to find specific information on this website, would you be able to do it. For example:
      i. If you needed to find a service, how would you find a service?
      ii. If you wanted to get a job at Surrey Place, where would you go to find jobs?
2. (**Go to Audiology page**). Can you read this? (**If not, go to accessibility feature question**)

     a. Are there any words that you don't understand? What do you think would help when you don't understand a word?
         i. Probe: For example, hovering over a word and the definition shows up or there is an audio version of the definition?
3. Can you find the accessibility features on this website?
     a. (Go through the accessibility feature first)
         i. How would you get the screen to read to you or how would you make the text bigger, is there any other accessibility features that you would find helpful that is not present?
     b. (Enable the screen reader to read to them):
         i. Did you understand the text once it was read to you?
     c. Are there any words that you don't understand? What do you think would help when you don't understand a word?
         i. Probe: hover over a word and the definition shows up or there is an audio version of the definition
     d. Do you find the accessibility features helpful?
4. What would make this website better or easier to understand? (Thinking about the presentation, such as multiple down menus)

Performing a Task:

Job Banks: https://www.jobbank.gc.ca/home
1. Could you navigate this page?
2. Then go to next page, would you know what to do here?

OR

Indeed: https://ca.indeed.com/
- Show us how you would find a job and complete the process of applying.
     o Probe as they go through: What do you find difficult with navigating this website?

Searching:
1. How would you search for a recreational activity for yourself (this could be a swimming course, volleyball league, soccer league, bowling league, and arts class)?

8.0 Appendix B

Decision Tree for Enhancing Accessibility to ICT for People with Intellectual and Developmental Disabilities

Start

Is it a content-related issue?

Yes

Is it a formatting issue?

No

Speech-to-text software can help users to read Word documents, html files, or text files online.

1. Is it a formatting issue?

Yes

Reformatting is required.

What reformatting is needed?

1.1 Text Spacing. Included in current WCAG 2.1 Success Criteria (SC) specifically 1.2 and 1.4 which deal with text spacing, line height, spacing between paragraphs, letter and word spacing.
1.2 Increase font size or type, or provide option to zoom in/out in browser. Included in current WCAG 2.1 Success Criterion 1.4.4 which deals with resizing text and 1.4.8 which deals with visual presentation. Success is achieved if the text can be resized without assistive technology up to 200%.

- References:
- Auger, C., Leduc, D., Labbe, D., Guay, C., Fillion, B., Bottari, C., & Swine, B. (2014). Mobile applications for participation at the shopping mall: Content analysis and usability for persons with physical and communication or cognitive limitations. *International Journal of Environmental Research and Public Health 11(12)*, 12777-12794.
- Bridges, S. A., Robinson, O.P., Stewart, E.W., Kwon, D. & Mutua, K. (2020). Augmented reality: Teaching daily living skills to adults with intellectual disabilities. *Journal of Special Education Technology 35(1)*, 3-14.

- Vereenooghe, L., Turssat, F., & Baucke, K. (2021). Applying the Technology Acceptance Model to Digital Mental Health Interventions: A Qualitative Exploration with Adults with Intellectual Disabilities. *Journal of Mental Health Research in Intellectual Disabilities 14(3),* 318-343.

1.3 Change background and/or text colour on device. Dealt with by guideline 1.4 Distinguishable that is meant to ensure that users can see and hear content and that foreground is separated from background. SC 1.4.8 deals specifically with user ability to change foreground and background colours.

1.4 Use images or audio as supplement or alternative to text. No current WCAG 2.1 recommendation.

- References:
- Rocha, T., Bessa, M., Goncalves, M., Cabral, L., Godinho, F., Peres, E., Reis, M.C., Magalhaes, L., & Chalmers, A. (2012). The recognition of web pages' hyperlinks by people with intellectual disabilities: An evaluation study. *Journal of Applied Research in Intellectual Disabilities 25(6),* 542-552
- Vereenooghe, L., Turssat, F., & Baucke, K. (2021). Applying the Technology Acceptance Model to Digital Mental Health Interventions: A Qualitative Exploration with Adults with Intellectual Disabilities. *Journal of Mental Health Research in Intellectual Disabilities 14(3),* 318-343.

Is it a site organization issue?

Yes

What changes are needed?

2.1 Include visual cues (e.g., place focus on currently active tab). Included in current WCAG 2.1 Guidelines as SC 2.4.7 Focus Visible.
Supporting References:
- Vereenooghe, L., Turssat, F., & Baucke, K. (2021). Applying the Technology Acceptance Model to Digital Mental Health Interventions: A Qualitative Exploration with Adults with Intellectual Disabilities. *Journal of Mental Health Research in Intellectual Disabilities 14(3),* 318-343.
2.2 Simplify menu structure (e.g., don't use lengthy drop down menus). Included in current WCAG 2.1 guidelines as SC 2.4.8 Location information about user's location within a set of web pages.
Supporting References:
- Rocha, T., Bessa, M., Goncalves, M., Cabral, L., Godinho, F., Peres, E., Reis, M.C., Magalhaes, L., & Chalmers, A. (2012). The recognition of web pages' hyperlinks by people with intellectual disabilities: An evaluation study. *Journal of Applied Research in Intellectual Disabilities 25(6),* 542-552
2.3 Clearly label URLs. Included in current WCAG 2.1 guidelines as SC 2.4.4 and 2.4.9. The link purpose can be determined by the link text alone.
Supporting References:
- Rocha, T., Bessa, M., Goncalves, M., Cabral, L., Godinho, F., Peres, E., Reis, M.C., Magalhaes, L., & Chalmers, A. (2012). The recognition of web pages' hyperlinks by people with intellectual disabilities: An evaluation study. *Journal of Applied Research in Intellectual Disabilities 25(6),* 542-552

2.4 Use titles for pages. Included in the current WCAG 2.1 guidelines as SC 2.4.2. Page Titled. Help users to find content and orient themselves by giving each web page a descriptive title.
Supporting References:

- Vereenooghe, L., Turssat, F., & Baucke, K. (2021). Applying the Technology Acceptance Model to Digital Mental Health Interventions: A Qualitative Exploration with Adults with Intellectual Disabilities. *Journal of Mental Health Research in Intellectual Disabilities 14(3),* 318-343.

2.5 Provide consistent look and feel across site. Included in current WCAG 2.1 guidelines as SC 3.23 and 3.2.4. Consistent navigation, icons/images used repeatedly, and are consistent.
Supporting References:

- Barlott, T., Aplin, T., Catchpole, E., Kranz, R., Le Goullon, D., Toivanen, A., & Hutchens, S. (2020). Connectedness and ICT: Opening the door to possibilities for people with intellectual disabilities. *Journal of Intellectual Disabilities 24(4),* 503-521.
- Chalghoumi, H., Cobigo, V., Dignard, C., Gauthier-Beaupre, A., Jutai, J.W., Lachappelle, Y., Lake, J., McHeimech, R., & Perrin, M. (2017). Information privacy for technology users with intellectual and developmental disabilities: Why does it matter? *Ethics & Behavior 29(3),* 201-217.
- Davies, D. K., Stock, S.E., King, L.R., Brown, R.B., Wehmeyer, M.L., & Shogren, K.A. (2015). An interface to support independent use of Facebook by people with intellectual disability. *Intellectual and Developmental Disabilities 53(1),* 30-41.
- Kumin, L., Lazar, J., Feng, J.H., Wentz, B., & Ekedebe, N. (2012). A usability evaluation of workplace-related tasks on a multi-touch tablet computer by adults with Down Syndrome. *Journal of Usability Studies 7(4),* 118-0142.
- Vereenooghe, L., Turssat, F., & Baucke, K. (2021). Applying the Technology Acceptance Model to Digital Mental Health Interventions: A Qualitative Exploration with Adults with Intellectual Disabilities. *Journal of Mental Health Research in Intellectual Disabilities 14(3),* 318-343.

3. Is understandability an issue?

Yes.

User struggles to understand and to generate text-based content.

What changes are needed?

3.1 Use specialist terms, and jargon sparingly and if used, define. Included in current WCAG 2.1 guidelines as SC 3.1.3 unusual words.
Supporting References:

- Chalghoumi, H., Cobigo, V., Dignard, C., Gauthier-Beaupre, A., Jutai, J.W., Lachappelle, Y., Lake, J., McHeimech, R., & Perrin, M. (2017). Information privacy for technology users with intellectual and developmental disabilities: Why does it matter? *Ethics & Behavior 29(3),* 201-217.

3.2 Complex sentences, and long paragraphs should be replaced with chunked content as per plain language guidelines. Implied in the current WCAG 2.1 guidelines as SC 3.1.5

Reading Level. However, the stated reading level, lower secondary, is too high for the IDD population so that will need to be modified.
Supporting References:

- Havousha, S. (2016). *Usability of a Hebrew-based social media interface designed for individuals with intellectual developmental disability*. Haifa, Israel, University of Haifa. 99p.
- Lake, J. K., Jachyra, P., Volpe, T., Lunsky, Y., Magnacca, C., Marcinkiewicz, A., & Hamdani, Y (2021). The wellbeing and mental health care experiences of adults with intellectual and developmental disabilities during COVID-19. *Journal of Mental Health Research in Intellectual Disabilities 14(3)*, 285-300.
- Ramsten, C., Martin, L., Dag, M., & Hammar, L.M. (2020). Information and communication technology use in daily life among young adults with mild-to-moderate intellectual disability. *Journal of Intellectual Disabilities 24(3)*, 289-303.
- Rocha, T., Bessa, M., Goncalves, M., Cabral, L., Godinho, F., Peres, E., Reis, M.C., Magalhaes, L., & Chalmers, A. (2012). The recognition of web pages' hyperlinks by people with intellectual disabilities: An evaluation study. *Journal of Applied Research in Intellectual Disabilities 25(6)*, 542-552

3.3 Limit requirement for text only input where possible. No current WCAG 2.1 guideline is available.
Supporting References:

- Lake, J. K., Jachyra, P., Volpe, T., Lunsky, Y., Magnacca, C., Marcinkiewicz, A., & Hamdani, Y (2021). The wellbeing and mental health care experiences of adults with intellectual and developmental disabilities during COVID-19. *Journal of Mental Health Research in Intellectual Disabilities 14(3)*, 285-300.

3.4 Provide supports (e.g., glossaries, contextual help) when text-based inputs are required (e.g., search terms, text chat). Included, in part, in the WCAG 2.1 SC 3.1.6 Pronunciation which includes mention of glossaries in the Examples section.

- Supporting References:
- Barlott, T., Aplin, T., Catchpole, E., Kranz, R., Le Goullon, D., Toivanen, A., & Hutchens, S. (2020). Connectedness and ICT: Opening the door to possibilities for people with intellectual disabilities. *Journal of Intellectual Disabilities 24(4)*, 503-521.
- Rocha, T., Carvalho, C., Bessa, M., Reis, S., & Magalhaes, L. (2017). Usability evaluation of navigation tasks by people with intellectual disabilities: A Google and SAPO comparative study regarding different interaction modalities. *Universal Access in the Information Society 16(3)*, 581-592.
- Vereenooghe, L., Turssat, F., & Baucke, K. (2021). Applying the Technology Acceptance Model to Digital Mental Health Interventions: A Qualitative Exploration with Adults with Intellectual Disabilities. *Journal of Mental Health Research in Intellectual Disabilities 14(3)*, 318-343.

Is it a technology-related issue?

Yes

4. Are changes to software/device setup challenging for users?

Yes

User struggles to install new software or manage changes resulting from updates to purchase of new devices.

What changes are needed?

4.1 Removal of distracting content from software installation emails or downloads. Implied in the current WCAG 2.1 guidelines as SC 3.1.5 Reading Level. However, the stated reading level, lower secondary, is too high for the IDD population so that will need to be modified.
Supporting References:
- Rocha, T., Carvalho, C., Bessa, M., Reis, S., & Magalhaes, L. (2017). Usability evaluation of navigation tasks by people with intellectual disabilities: A Google and SAPO comparative study regarding different interaction modalities. *Universal Access in the Information Society 16(3)*, 581-592.

4.2 Make the installation or maintenance processes very concrete/clear (e.g., pictorial representations, plain language). Implied in the current WCAG 2.1 guidelines as SC 3.1.5 Reading Level. However, the stated reading level, lower secondary, is too high for the IDD population so that will need to be modified.
Supporting References:
- Ramsten, C., Martin, L., Dag, M., & Hammar, L.M. (2020). Information and communication technology use in daily life among young adults with mild-to-moderate intellectual disability. *Journal of Intellectual Disabilities 24(3)*, 289-303.
- Rocha, T., Bessa, M., Goncalves, M., Cabral, L., Godinho, F., Peres, E., Reis, M.C., Magalhaes, L., & Chalmers, A. (2012). The recognition of web pages' hyperlinks by people with intellectual disabilities: An evaluation study. *Journal of Applied Research in Intellectual Disabilities 25(6)*, 542-552.
- Rocha, T., Carvalho, C., Bessa, M., Reis, S., & Magalhaes, L. (2017). Usability evaluation of navigation tasks by people with intellectual disabilities: A Google and SAPO comparative study regarding different interaction modalities. *Universal Access in the Information Society 16(3)*, 581-592.
- Setchell, J., Barlott, T., & Torres, M. (2021). A socio-emotional analysis of technology use by people with intellectual disabilities. *Journal of Intellectual Disability Research 65(12)*, 149-161.
- Shpigelman, C. N. & C. J. Gill (2014). How do adults with intellectual disabilities use Facebook? *Disability & Society 29(10)*, 1601-1616.
- van Holstein, E., Wiesel, I., Bigby, C., & Gleeson, B. (2021). People with intellectual disability and the digitization of services. *Geoforum 119*, 133-142.

4.3 Indicate changes of context, through cues such as "Update Now" buttons rather than auto-updating. Included in the current WCAG 2.1 guidelines as SC 3.2.5 Change on Request.
Supporting References:
- Alfredsson Agren, K., Kjellberg, A., & Hemmingsson, H. (2020). Access to and use of the Internet among adolescents and young adults with intellectual disabilities in everyday settings. *Journal of Intellectual and Developmental Disability 45(1)*, 89-98.

- Shpigelman, C. N. & C. J. Gill (2014). How do adults with intellectual disabilities use Facebook? *Disability & Society 29(10),* 1601-1616.

4.4 Minimize and summarize changes to system/software. No WCAG 2.1 guideline addresses the issue directly or indirectly.

Supporting References:
- Kumin, L., Lazar, J., Feng, J.H., Wentz, B., & Ekedebe, N. (2012). A usability evaluation of workplace-related tasks on a multi-touch tablet computer by adults with Down Syndrome. *Journal of Usability Studies 7(4),* 118-0142.

5. Does requirement for text-based inputs limit usability?

Yes

User has difficulty generating text-based content.

What changes are needed?

5.1 Provide tools or utilities that prevent or correct errors (e.g., browser plug-ins) or work seamlessly with user Assistive Technology (AT). Included in current WCAG 2.1 guidelines as SC 3.3.1 Error Detection, and 3.3.4 and 3.3.6 Error Prevention.

Supporting References:
- Davies, D. K., Stock, S.E., King, L.R., Brown, R.B., Wehmeyer, M.L., & Shogren, K.A. (2015). An interface to support independent use of Facebook by people with intellectual disability. *Intellectual and Developmental Disabilities 53(1),* 30-41.

5.2 Provide context-sensitive help to prompt user as to the term they want to use.

Included in WCAG 2.1 guidelines as SC 3.3.5 Help.

5.3 Improve capabilities of AT like speech-to-text in discussion forums and chat rooms for those who struggle to generate multi-word phrases or sentences quickly. No current WCAG 2.1 guideline deals with this issue.

Supporting References:
- Rocha, T., Carvalho, C., Bessa, M., Reis, S., & Magalhaes, L. (2017). Usability evaluation of navigation tasks by people with intellectual disabilities: A Google and SAPO comparative study regarding different interaction modalities. *Universal Access in the Information Society 16(3),* 581-592.

6. Do users struggle to troubleshoot technical issues?

Yes

6.1 User struggles to solve issues on their own and often resorts to internal or external supports.

What changes are needed?

6.1.1 Provide just-in-time training modules online or f2f to build ICT self-efficacy. Dealt with only partially by WCAG 2.1 SC 3.3.5 Help.
Supporting References:
- Barlott, T., Aplin, T., Catchpole, E., Kranz, R., Le Goullon, D., Toivanen, A., & Hutchens, S. (2020). Connectedness and ICT: Opening the door to possibilities for people with intellectual disabilities. *Journal of Intellectual Disabilities 24(4),* 503-521.

6.1.2 Direct user to support network in their area if they do not currently have adequate support (internal or external). No current WCAG 2.1 guideline deals with this topic.

6. Do users struggle to troubleshoot technical issues?

No

6.2 User is confident enough to pursue a solution on their own.

What changes are needed, if any?

6.2.1 Provide ongoing training and support to user to help build and reinforce their ICT skills. No current WCAG 2.1 guideline deals with training needs.
Supporting References:
- Barlott, T., Aplin, T., Catchpole, E., Kranz, R., Le Goullon, D., Toivanen, A., & Hutchens, S. (2020). Connectedness and ICT: Opening the door to possibilities for people with intellectual disabilities. *Journal of Intellectual Disabilities 24(4),* 503-521.

6.2.2 Support user to become peer support provider of tech help to their community to build and maintain their skills. No current WCAG 2.1 guideline deals with training needs.