Living Labs and Open Toolkit for the co-design of accessible IT systems and tools

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Contents

EXECUTIVE SUMMARY **6**

1 INTRODUCTION **6**

1.1 PURPOSE AND SCOPE 6
1.2 INTENDED AUDIENCE 6
1.3 DOCUMENT STRUCTURE 7
1.4 CONNECTIONS TO OTHER WPS 7
1.5 A NOTE ON THE TASK 2.4 RESULTS 8

2 SCENARIOS AS PRESENTED IN D.2.2 ..... **9**

2.1 KEY TERMS 9
2.2 HELP & SUPPORT 10
2.3 SELF-DEVELOPMENT 11
2.4 LIFE SKILLS 11
2.5 EMERGENCIES 12

3 SCENARIO VALIDATION **13**

3.1 METHODS 14
3.1.1 Scenario Validation Methods Overview *15*
3.1.2 A Note on Evaluation *16*
3.1.3 Research Questions Guiding Scenario Validation *18*
3.2 RESULTS 19
3.2.1 Overall Scenario Validation Themes *19*
3.2.2 Key Terms *19*
3.2.3 Help & Support Scenario Validation Results *20*
3.2.4 Self-Development Scenario Validation Results *28*
3.2.5 Life Skills Scenario Validation Results *34*
3.2.6 Emergencies Scenario Validation Results *40*

4 SCENARIOS FOR ALL **48**

4.1 HELP & SUPPORT 48
4.1.1 Original Scenarios *49*
4.1.2 Revised Scenarios *57*
4.1.3 New Scenarios *57*
4.2 SELF-DEVELOPMENT 63
4.2.1 Original Scenarios *63*
4.2.2 Revised Scenarios *68*
4.2.3 New Scenarios *71*
4.3 LIFE SKILLS 75
4.3.1 Original Scenarios *75*
4.3.2 Revised Scenarios *84*
4.3.3 New Scenarios *86*

4.4 EMERGENCIES 87
4.4.1 Original Scenarios *87*
4.4.2 Revised Scenarios *108*
4.4.3 New Scenarios *109*
5 END-USERS' CHALLENGES DURING USE OF ASSISTIVE TOOLS 112
5.1 SUMMARY 112
5.2 AVERSION, ANXIETY AND READING DIFFICULTY 115
5.3 ANALYSIS 117
5.4 READING ABILITY 119
5.5 DEVICES, SKILLS AND TOOLS USAGE HELP 119
5.6 CORRELATING CHALLENGE FACTORS 121
5.7 CONCLUSIONS 122
6 THE GENDER DIMENSIONS 123
6.1 POSITIONING THE GENDER DIMENSION IN LIVE IT 123
6.2 OVERVIEW: GENDER, COGNITIVE DISABILITY AND DIGITAL LIFE 124
6.3 KEY FINDINGS FROM LIVE IT'S PRELIMINARY RESEARCH 128
6.3.1 Findings from the focused review and interventions audit *128*
6.3.2 Findings from the lifeworld analysis *129*
6.4 GENDER REPRESENTATION IN THE LIVE IT PROJECT 131
6.5 GENDER VARIATIONS IN USE OF TOOLS AND THEIR ASSOCIATED OUTCOMES 133
6.5.1 Survey findings *133*
6.5.2 Findings from the observation, focus groups and interviews *137*
6.6 CONCLUSIONS AND IMPLICATIONS 140
6.6.1 Key conclusions *140*
6.6.2 Implications for the future *142*
7 DIAGNOSES' SPECTRUM IN LIVE IT 144
7.1 MAKERSPACE AND HACKATHONS 144
7.2 CO-LABS 149
8 GENERATED RECOMMENDATIONS AND GUIDELINES 149
8.1 RESEARCHERS 149
8.2 POLICYMAKERS 152
8.3 DESIGNERS AND DEVELOPERS 155
8.4 STAKEHOLDER - GENERATED RECOMMENDATIONS FOR DESIGNERS AND DEVELOPERS 158
9 CONCLUSION 161
10 REFERENCES 162

EXECUTIVE SUMMARY

1 INTRODUCTION

1.1 PURPOSE AND SCOPE

The aim of this document is to tell the story of scenario implementation and revision within the LIVE IT Project co-design labs. This report includes descriptions of the initial scenarios, how the initial scenarios were revised to meet the needs of participants and support project goals, and the organic development of new scenarios. Additionally, this report includes a list of validated scenarios for all.

This document includes the validated LIVE IT Scenarios, through which, the four LIVE IT co-design labs used clusters and configurations of tools with people with cognitive disabilities. The results of the *use* of the clusters and configurations of tools are presented in The Final Evaluation Report. This report is not a deliverable required by the DoA. However, the LIVE IT Consortium view the validated scenarios contained in this document as a resource
For future web accessibility research with people with cognitive disabilities.

In the next four sections of this introduction, we describe the intended audience for this report, the document structure, the connections to other LIVE IT work packages, and a note about the parameters of the results presented in this report. We intend for this introduction to situate the scenarios validation report between the initial scenario development reported on in Deliverable 2.2 and the user feedback results gathered during scenario implementation reported on in The Final Evaluation Report.

1.2 INTENDED AUDIENCE

The intended audience for this document is comprised of: LIVE IT Consortium partners, researchers, developers, and groups and organisations supporting and advocating for people with cognitive disabilities.

This report describes the process by which the LIVE IT Scenarios initially presented in Deliverable 2.2 were implemented and evaluated, which is valuable as a framework for those continuing to conduct web accessibility research with people with cognitive disabilities. Additionally, the report concludes with a comprehensive roadmap for implementing the validated scenarios.

1.3 DOCUMENT STRUCTURE

In Chapter 2, we review the initial scenarios as presented in LIVE IT Deliverable 2.2 to allow the reader to understand the scenario revision and validation process without having to read all of Deliverable 2.2. Chapter 2 presents only an overview of the initial scenarios. For a complete description of how the initial scenarios were designed, see Deliverable 2.2.

In Chapter 3, we present the scenario validation methods and results. Scenario implementation and revision is described for the purpose of supporting scenario validation claims. It is important to note here that the results of the scenario validation are split into two categories: 1) results focused on the scenarios, and 2) results focused on the tools used within the scenarios. This report is dedicated to the first category of results. The results focused on the tools used within the scenarios, including user feedback on the tools is included in The Final Evaluation Report. We do this so that a record of the set of validated scenarios is available for future research on web accessibility with people with cognitive disabilities. Additionally, the user feedback data was highly connected to the LIVE IT Hackathons, which are not a part of this report.

In Chapter 4, we present the updated set of LIVE IT Scenarios for All. These are the complete set of scenarios validated in the co-design labs The Scenarios for All presented in Chapter 4 are a refinement of the scenarios described in Deliverable 2.2, because they include those initial scenarios developed for Deliverable 2.2 that were validated in addition to revised scenarios and new scenarios developed since the submission of Deliverable 2.2. In Chapter 5, we present issues identified during the co-lab interactions with digital tools.

In Chapter 6, we present the gender dimension of LIVE IT and its analysis, while in Chapter 7 we present the diagnoses' spectrum of the participants in the project. In Chapter 8, we provide a set of recommendations generated based upon the results and finding of the LIVE IT project.

1.4 CONNECTIONS TO OTHER WPS

LIVE IT Scenario implementation, revision, development, and validation is connected to:

- WP1: Initial scenarios drew on baseline research
- WP2: Lifeworld analysis and all co-design lab activities feed into scenario development and validation
- WP3: Scenario outcomes inform Open Toolkit development
- WP4: Scenario experimentation ultimately overlapped Hackathon activities
- WP5: Scenarios for All will be shared with the community to support further research

During WP1, the LIVE IT Partners conducted baseline research to establish the ‘state-of-the-art’ of web accessibility for people with cognitive disabilities. This was accomplished through a rapid review of the academic literature (reported in Deliverable 1.1), a grey literature review (reported in the Addendum to Deliverable 1.1), and a parallel search of available tools and platforms that support accessibility for people with cognitive disabilities (reported in Deliverable 1.2). The

baseline research conducted in WP1 informed the development of the LIVE IT co-design labs and the LIVE IT Scenarios for All.

Within WP2, Task 2.2 took the platforms, tools and practices collected through the WP1 activities described above and explored how they might offer solutions to the needs and challenges PwCD experience in real life through the use of testable scenarios in the co-design labs. Each LIVE IT Co-Lab developed an initial set of scenarios built on the foundation of tools and best practices established during WP1. This initial set of scenarios and the methods for developing them are reported in Deliverable 2.2. These accessibility scenarios were then subsequently validated in Task 2.4 through their implementation in the LIVE IT Co-Labs. This report describes the scenario validation process and shares the final validated set of Scenarios for All.

In WP3, the LIVE IT Partners worked to develop and refine the LIVE IT Open Toolkit through the use of scenarios. User feedback was collected about both the tools *and* the LIVE IT Open Toolkit during scenario implementation. This user feedback is reported in The Final Evaluation Report. However, we want to make clear that the scenarios presented in this report allowed LIVE IT Partners to gather that user feedback data.

In WP 4, the LIVE IT Hackathons were carried out to continue improving the LIVE IT Open Toolkit and to continue working towards developing innovations to support web accessibility for PwCD. LIVE IT Co-Lab work overlapped the Hackathon activities in that the Co-Lab facilitators supported teams of PwCD who participated in each of the LIVE IT Hackathons. Often, an ideal method for supporting PwCD during the hackathons was to rely on the validated scenarios to structure the team activities during the Hackathons. Thus, the validated scenarios presented in this report also helped to generate the user feedback on the Hackathons presented in Deliverable 4.4.

1.5 A NOTE ON THE TASK 2.4 RESULTS

Because the LIVE IT Project is a complex undertaking, we want to make clear the parameters and boundaries of Task 2.4 and the results presented in this report. The results of Task 2.4 are recommendations for scenarios to be further explored in the LIVE IT Co-Labs and Hackathons and future research. The results of Task 2.4 are *not* the outcomes of the use of tools, such as user feedback. The outcomes of the use of tools will be presented in The Final Evaluation Report. The results presented in this report are the validated scenarios.

2 SCENARIOS AS PRESENTED IN D.2.2

In this chapter, we review the scenarios as presented in Deliverable 2.2. We do this so that the reader may continue through this report without having to return to Deliverable 2.2. However, this section does not report on the details of how the initial scenarios were developed. For that information, see Deliverable 2.2.

This chapter begins with a presentation of key terms. Then, the initial scenarios for each of the four LIVE IT Co-Design Labs are presented in the following order: Help & Support, Self-Development, Life Skills, and Emergencies. That order is maintained for all sections throughout this document.

2.1 KEY TERMS

Before presenting the scenarios and embedded experiments as presented in *Deliverable 2.2*, we revisit a few key definitions.

Scenario: A narrative description of the lifecycle of a user need within the project. A scenario tracks the user need from lifeworld analysis activities to co-lab activities to hackathon outcomes. A scenario includes descriptions of: problem(s) that need solution(s), platform(s) and tool(s) that could deliver a solution, and potential ways of using platform(s) and tool(s) in particular situations.

Experiment: A testable hypothesis related to a particular scenario. Each experiment includes descriptions of: procedures guided by a hypothesis, data collection tools, and a plan for data analysis.

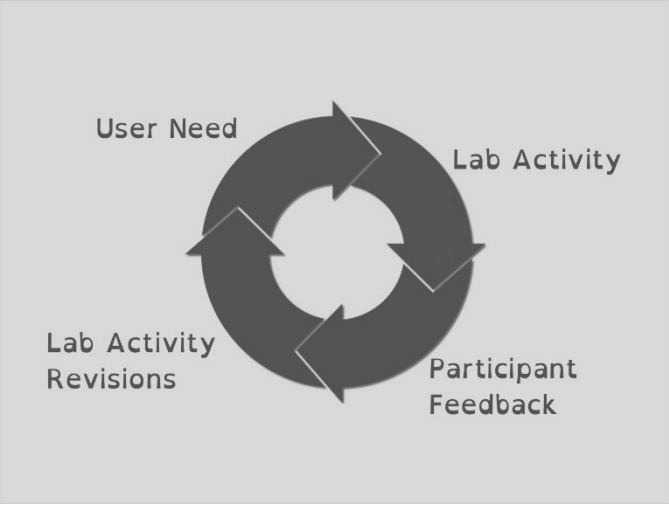


Figure 1: Scenarios & Experiments

The sections that follow provide a brief overview of the initial scenarios designed by the LIVE IT team. For a more in-depth discussion of these scenarios, please see *Deliverable 2.2: Scenarios*.

2.2 HELP & SUPPORT

The Help & Support Co-Design Lab developed scenarios and experiments focused on finding relevant information online, communicating with others using web-based tools, and troubleshooting problems using web-based resources and tools. The initial scenarios are depicted below: finding contact information online, finding an overnight pharmacy, navigating with Google Maps, and obtaining information via email.

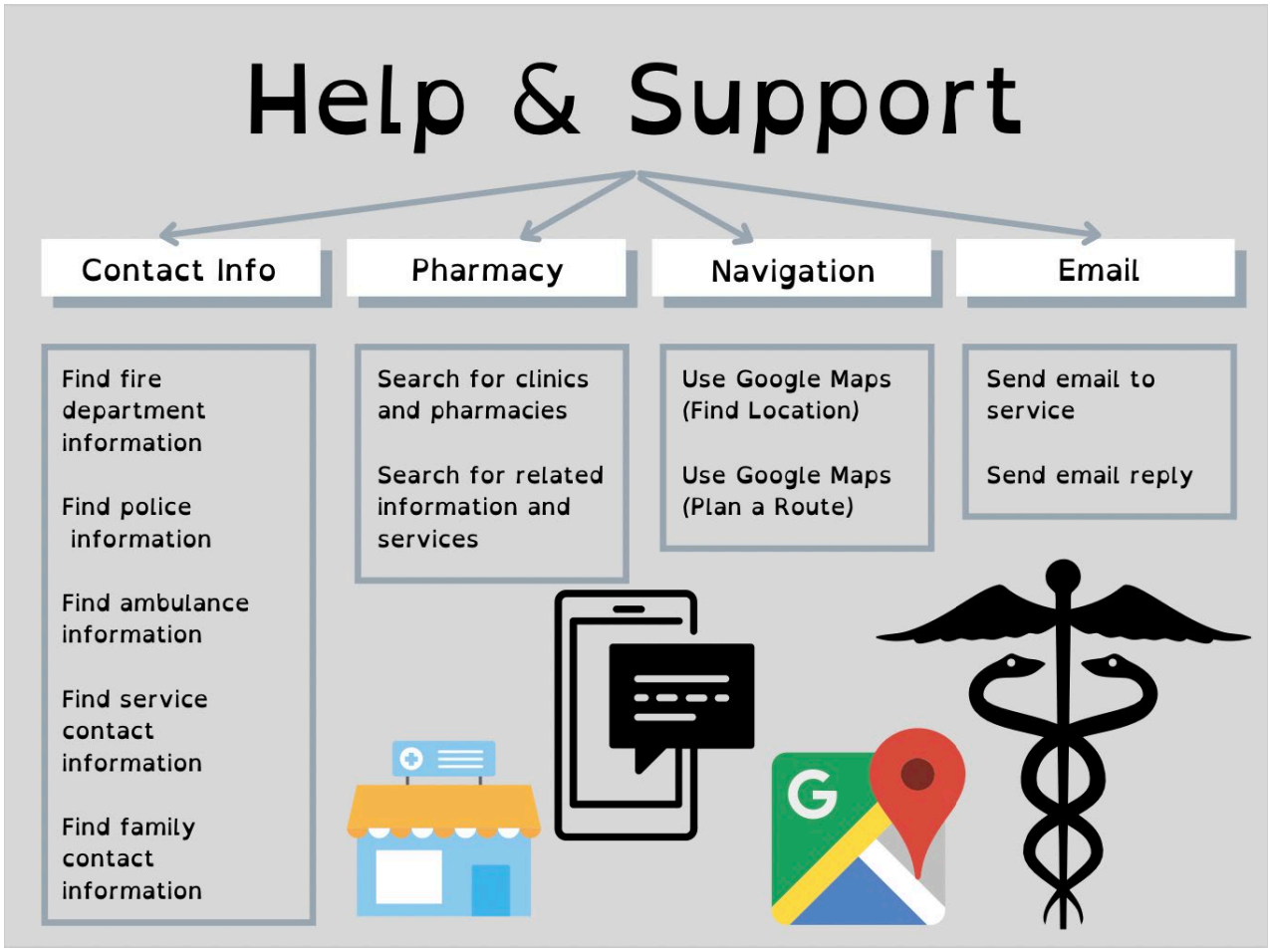


Figure 2: Help & Support Scenarios Overview

2.3 SELF-DEVELOPMENT

The Self-Development Co-Design lab developed scenarios and experiments focused on pursuing education, navigating employment, and communicating with others using web-based tools. The initial scenarios are depicted below: reading using an internet-connected device, writing by dictating to an internet connected device, and writing by typing on an internet connected device.

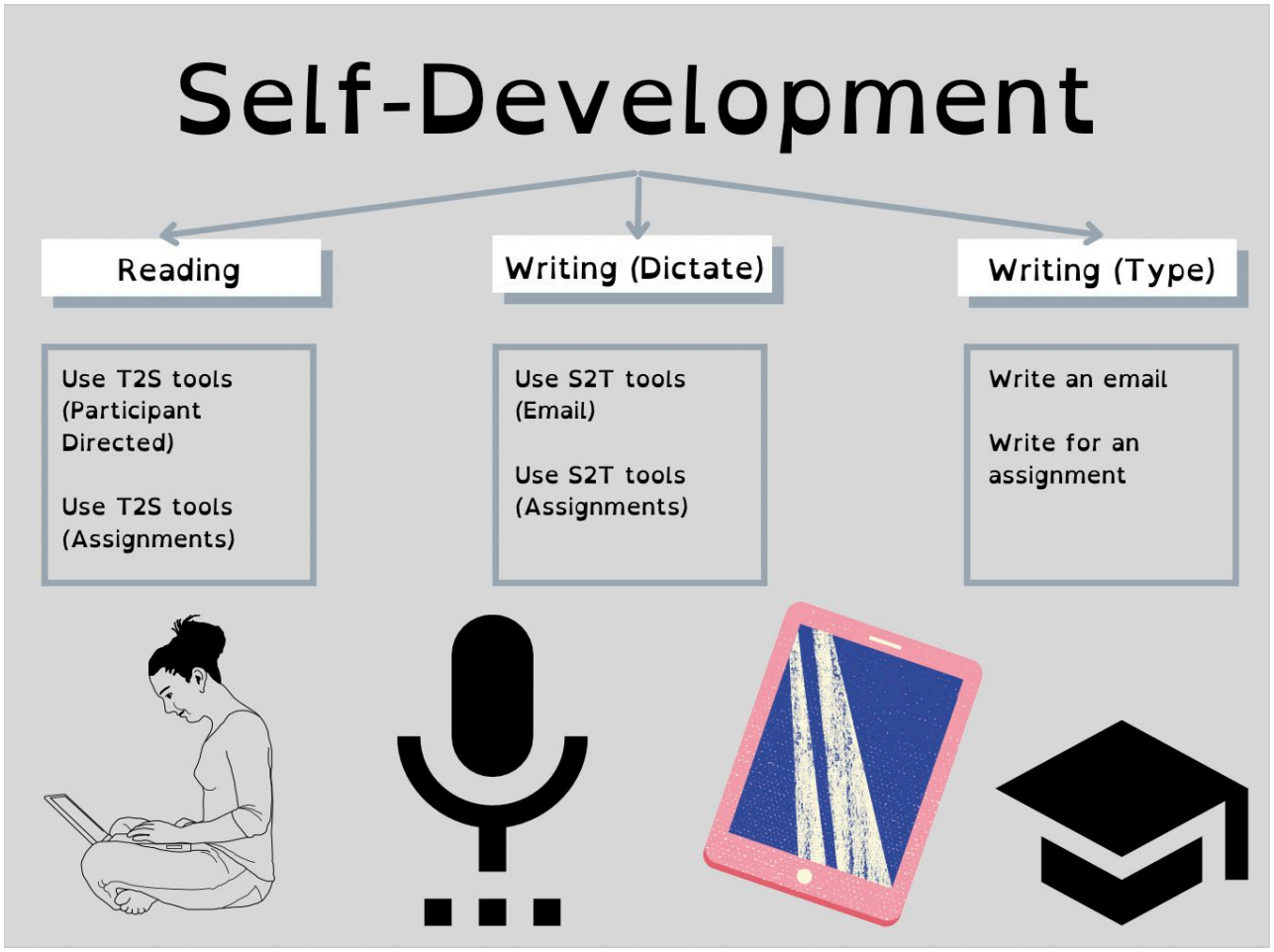


Figure 3: Self-Development Scenarios Overview

2.4 LIFE SKILLS

The Life Skills co-design lab developed scenarios and experiments focused on using transit, navigating employment, communicating with others, navigating healthcare, and buying necessary

goods. The initial scenarios are depicted below: using text-to-speech tools to assist in accomplishing daily tasks, using translation tools to obtain information and communicate with others, and using web-based tools to complete complex tasks.

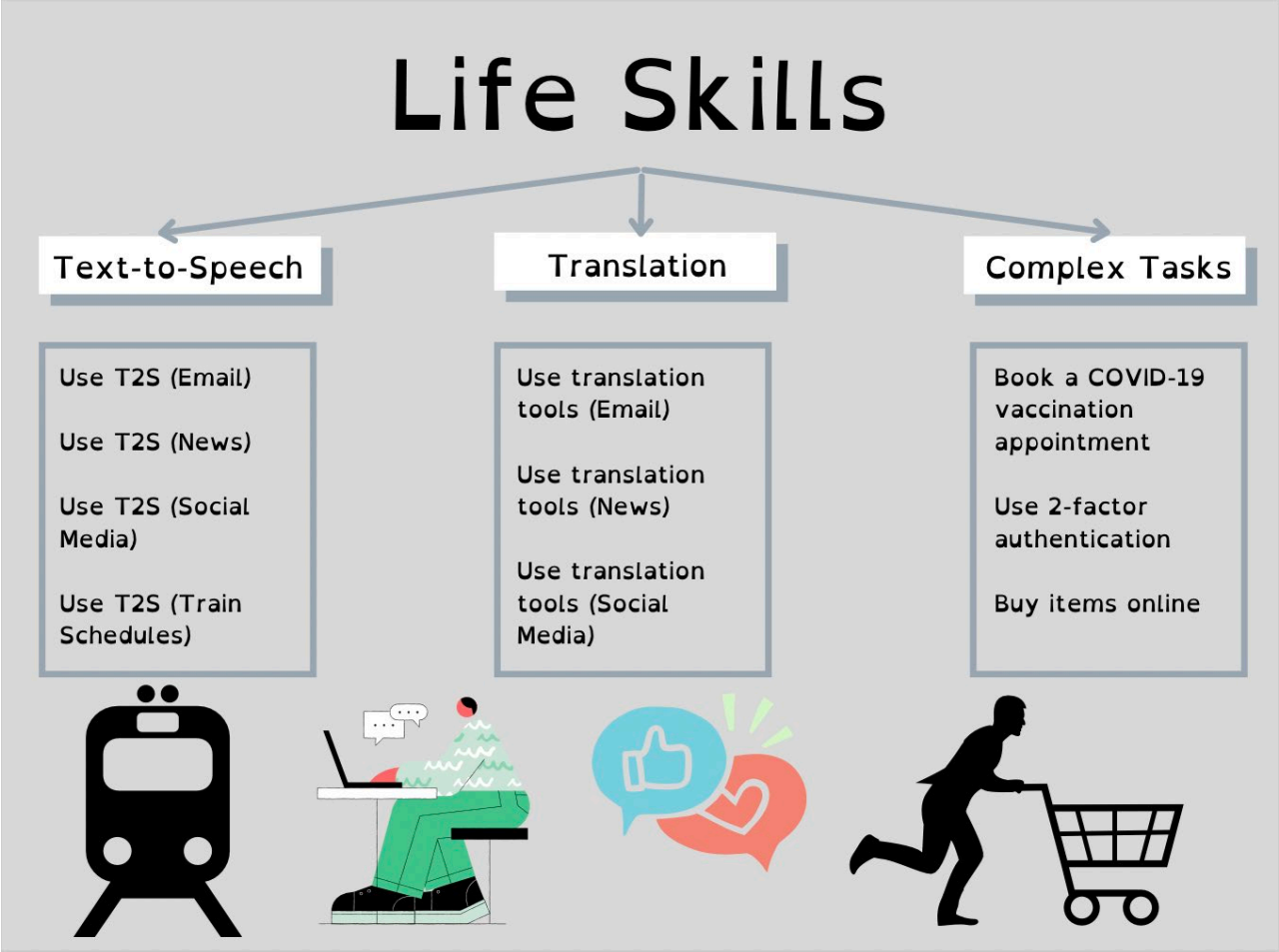


Figure 4: Life Skills Scenarios Overview

2.5 EMERGENCIES

The Emergencies Co-Design Lab developed scenarios and experiments focused on: responding to accidents that require medical attention, finding medical or psychological support, navigating life during natural disasters, handling home or work emergencies, seeking support from others. The initial scenarios are depicted below: finding help in an emergency, preparing for an emergency, what to do in an emergency, and optimising one's phone for use during emergencies (and daily life).

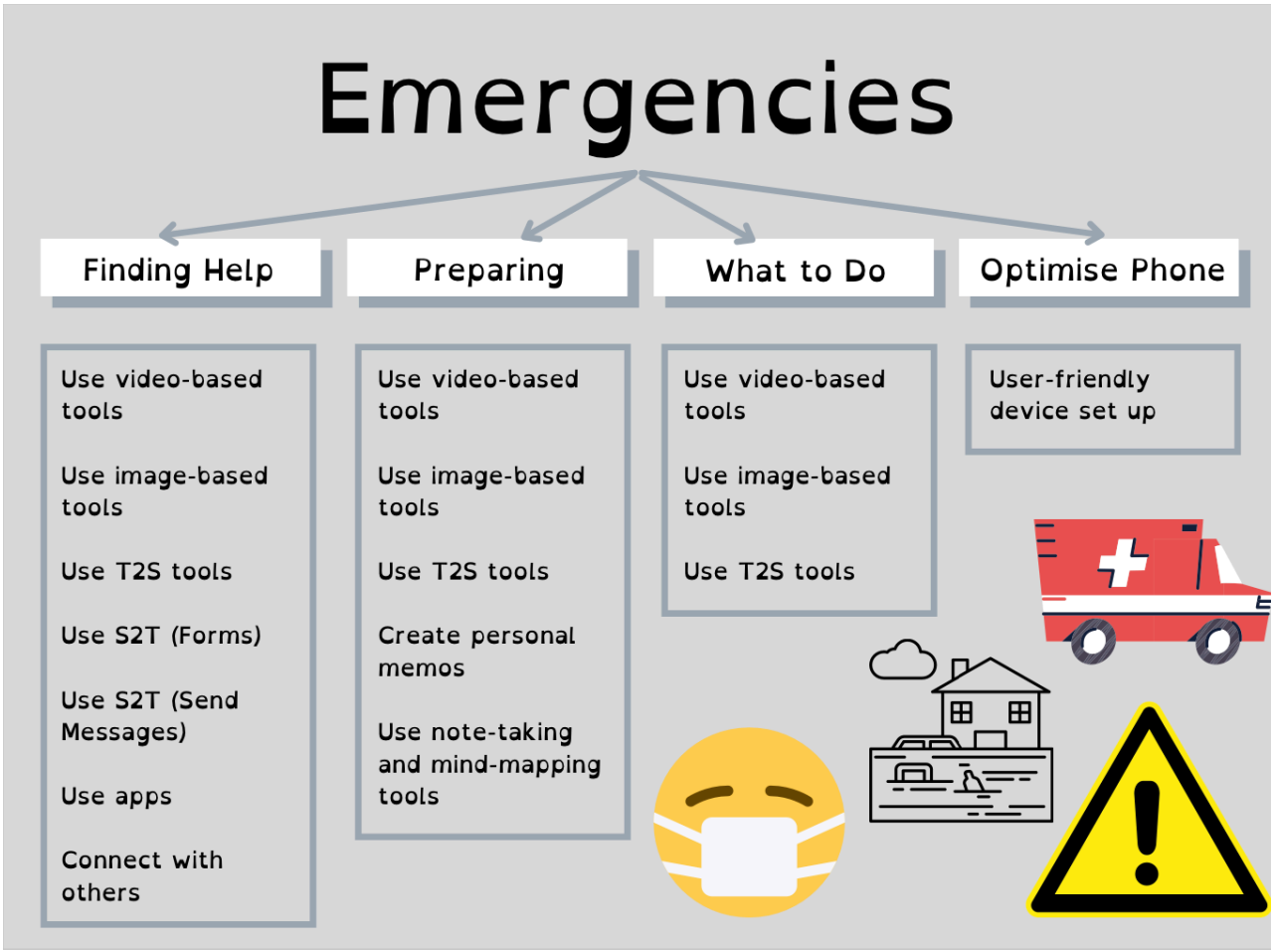


Figure 5: Emergencies Scenarios Overview

3 SCENARIO VALIDATION

In this Chapter, we describe the methods and results for the LIVE IT scenario validation. Generally speaking, we want scenarios to produce web accessibility solutions for people with cognitive disabilities. Additionally, we want the scenarios to produce such solutions through co-design processes that meaningfully engage people with cognitive disabilities. Therefore, the task of scenario validation answers a series of questions. First, is a scenario doing what we want it to do? If yes, are there any ways the scenario can be improved for use within and beyond our co-design labs? If no, can the scenario be revised? Or, does a new scenario need to be developed?

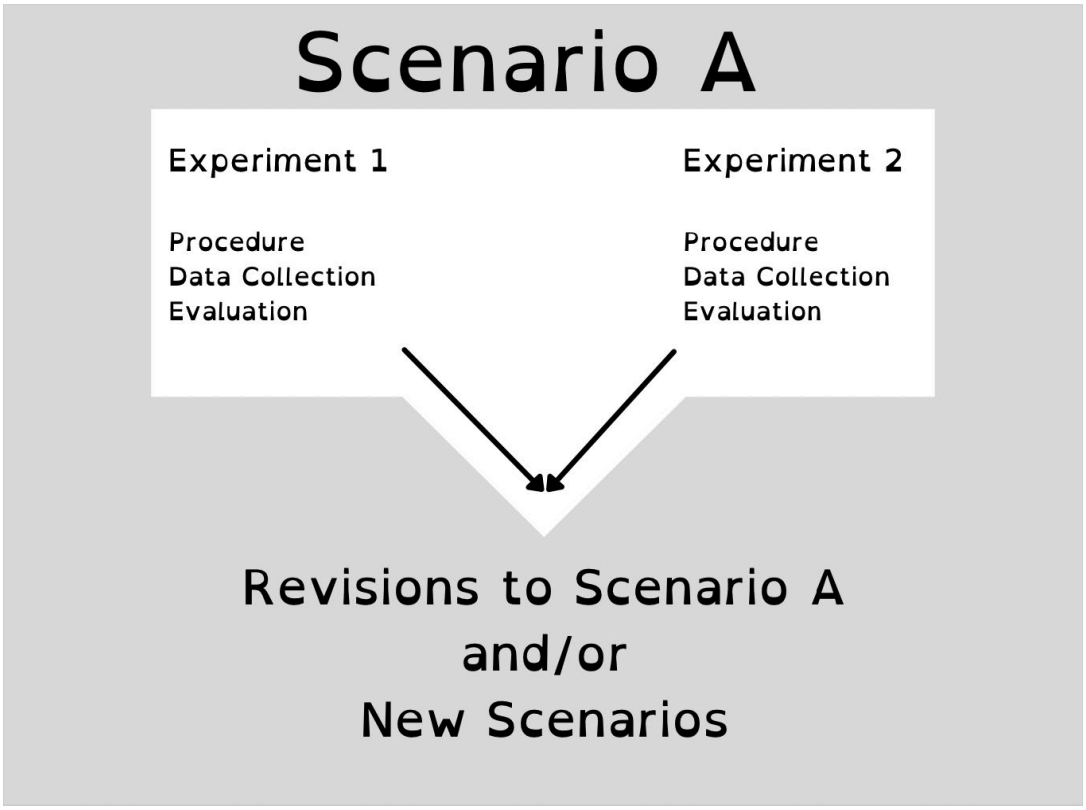


Figure 6: Scenario Validation

In the following sections, we present the methods for scenario validation within the LIVE IT Project. Then, we discuss the results of the scenario validation: that every co-design lab engaged in some scenario revision, that some co-design labs developed new scenarios, and that the scenarios could be used to support hackathon participation. Finally, we conclude this section with a discussion of the implications of these findings for the LIVE IT Project and the wider community.

3.1 METHODS

The overarching methodology for scenarios development and validation mirrors that of the LIVE IT project as a whole in that it applies a 'design thinking approach' (Rowe 1987; Gobble, 2014; IDEO, 2014). In this methodology, the scenarios development and process involve: 1) an open exploration of the problem space (i.e. to develop the right things); 2) exploration of the solution space (i.e. to develop things right); and 3) the iterative alignment of these two phases whenever it is needed. This process is implemented through the co-creation process - empathizing – gaining an empathetic understanding of the problem; identifying – stating the problem from a human

perspective; ideating – identifying new solutions by thinking outside the box; prototyping – developing new solutions to the problem; testing – evaluating the solutions.

Within this over-arching framework we used an adapted and abridged version of 'contribution analysis' to capture the processes and dynamics through which scenarios were explored and evolved. Contribution analysis is used in programme and project evaluation to create a causal chain – or 'contribution story' – that links actions and events to outcomes (Mayne, 2012). The contribution story sets out the attribution problem to be addressed – specifying the outcome or target that is hoped to improve or change; develops a theory of change about how the intervention is supposed to work; gathers evidence to assess whether the Theory of Change works, and explores plausible alternative explanations; assembles the Contribution Story to explain how and why a result is caused by a particular sequence of events and actions and then gathers new evidence to revise and strengthen the contribution story. In particular contribution analysis looks to identify and understand 'mechanisms' – the combination of factors which operate in particular contexts to generate outcomes of interest. In LIVE IT's scenarios development and validation, we wanted to capture the 'stories' for specific scenarios – how participants engaged with the scenarios; the actions they took to work with them and the mechanisms through which solutions to the challenges embedded in the scenarios were arrived at. In practical terms, this was done through a multi-methodological data collection approach, involving observation, walk-throughs, interviews and user feedback surveys.

3.1.1 Scenario Validation Methods Overview

The design cycle for the scenario validation is illustrated below in Figure 7. Within each Co-Lab, facilitators implemented the initial scenarios reviewed in Chapter 2 of this report. During implementation, facilitators made decisions with participants (PwCD) about altering or abandoning the scenarios selected for each lab session as participants engaged with the experiments within that scenario. All decisions were documented, and through what we refer to as 'informal data analysis,' which was an ongoing process during Co-Lab implementation, facilitators defined revised and new scenarios for their respective Co-Labs. Facilitator reflection also contributed to the scenario revision process.

Furthermore, the Co-Labs were all in constant communication with each other about details of the scenario implementation. Conversations about the use of tools and/or how experiments were playing out guided facilitators as they continued the scenario implementation. For example, if one lab had large amounts of data collected for one particular tool, that was communicated to the other labs so that a more comprehensive data set might be collected.

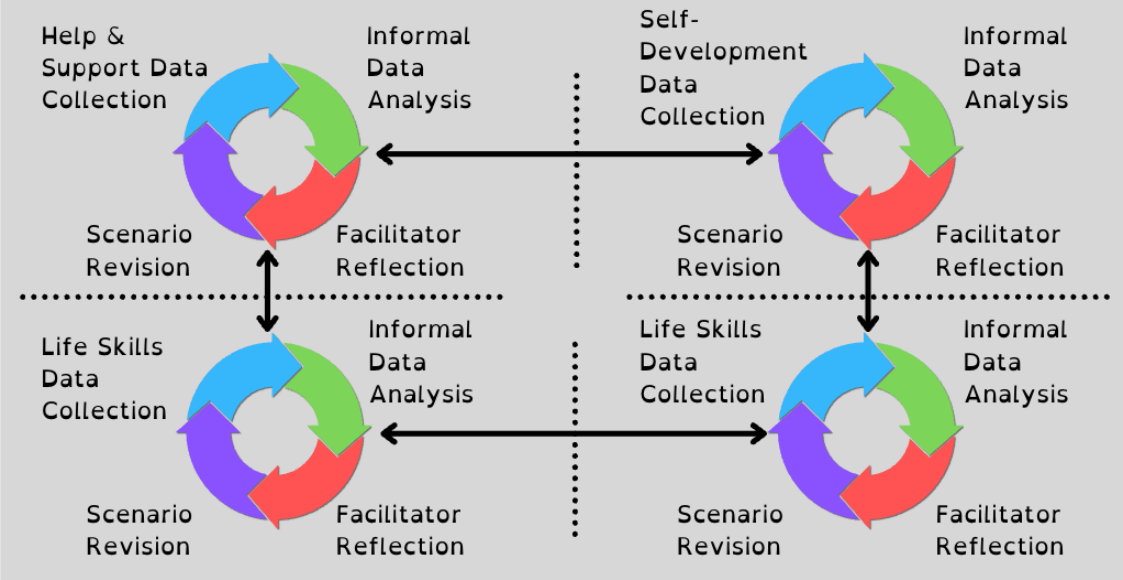


Figure 7: Co-Lab Level Scenario Evaluation

3.1.2 A Note on Evaluation

This is a good time to note the multi-level nature of the evaluation efforts within the LIVE IT Project. We will now define the types of evaluation taking place and explain how they are related to this report: 1) Evaluation of Tools and Platforms, 2) Evaluation of LIVE IT Open Toolkit, 3) Evaluation of Scenarios (or Scenario Validation).

Evaluation of Tools and Platforms: The LIVE IT scenarios and experiments are designed to elicit feedback on the tools and platforms that people with cognitive disabilities already use and/or use while engaged with the lab activities. All scenarios and experiments include some mechanism for obtaining participant feedback on their experiences with tools and platforms (see Figure 9 on the next page for an example). The data is used to ***both*** evaluate (and hopefully improve) the tools and planforms ***and*** evaluate the scenarios. This report focuses on the latter.

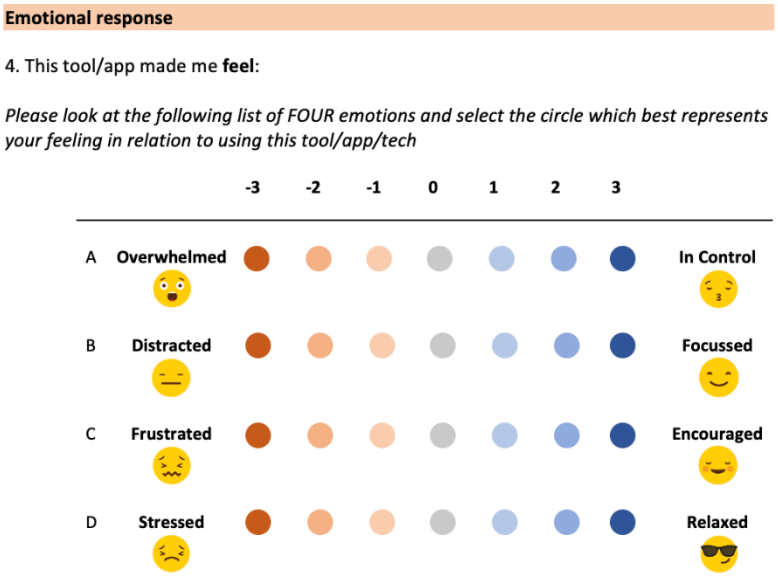


Figure 8: Excerpt from LIVE IT Tool Survey

Evaluation of LIVE IT Open Toolkit: The LIVE IT scenarios and experiments are designed to allow for feedback on a product of the LIVE IT Project – the LIVE IT Open Toolkit (see Figure 10 below). All scenarios and experiments involving participant use of the Open Toolkit include some mechanism for obtaining participant feedback on their experiences with the Open Toolkit. This data is used to ***both*** evaluate and improve the Open Toolkit ***and*** evaluate the scenarios. This report focuses on the latter.

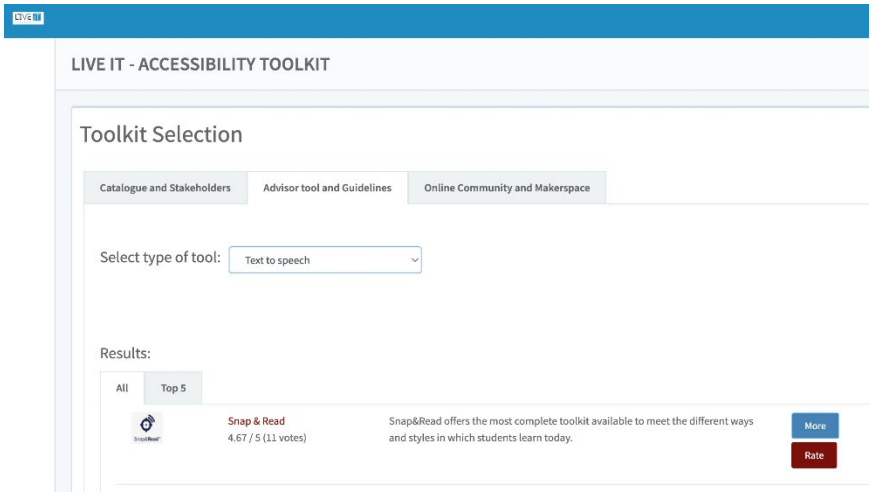


Figure 9: Screenshot of LIVE IT Open Toolkit Webpage

Evaluation of Scenarios: The LIVE IT scenarios and experiments are designed to be activities that co-design lab facilitators and participants with cognitive disabilities can engage in to develop relevant and real web accessibility solutions. In evaluating the scenarios, we are validating the scenarios and creating a set of *Scenarios for All*.

3.1.3 Research Questions Guiding Scenario Validation

Before presenting the results, we will describe the questions driving the scenario validation, the underlying theory of change, and the data collected in more detail.

Questions Driving LIVE IT Scenario Validation:

1) What web accessibility solutions exist for people with cognitive disabilities?
2) What web accessibility innovations are still needed?

3.2 RESULTS

The results presented in this report are the set of validated LIVE IT Scenarios for All. The set of scenarios, including procedures and tools used, are listed in Chapter 4 of this report. In this section, we present the implementation data focused on the scenarios. In other words, we provide a comprehensive roadmap for how we used, revised, and reimagined the scenarios presented in Deliverable 2.2 to create the final list of Scenarios for All listed in Chapter 4 of this report.

This results chapter is divided into multiple sections. First, we share some overall themes from the scenario validation process. Then, we highlight some key definitions to aid in the reading of the results. Then, we present scenario validation results by co-lab in this order: Help & Support, Self-Development, Life Skills, and Emergencies.

3.2.1 Overall Scenario Validation Themes

The data documenting the implementation of all scenarios and all experiments in all co-design labs consistently highlighted a singular theme. Procedural flexibility is imperative. Scenarios and experiments must be written, planned, and implemented responsively in order to fully include people with cognitive disabilities in the co-design process. Additionally, the everchanging landscape of the COVID-19 pandemic required a flexible yet well-documented approach. Thus, "successful" scenarios, or scenarios (and experiments) that lead to the co-development of potential web accessibility solutions for people with cognitive disabilities, are scenarios that:

- Are planned with input from participants
- Allow for in-the-moment pivots
- Allow for revision throughout implementation
- Maintain rigorous standards for data collection
- Centre the voices of participants

3.2.2 Key Terms

Before moving into the individual co-design lab sections a few additional definitions are provided for terms used across all sections. The terms are: *initial scenario*, *revised scenario*, *new scenario*, *successful implementation*, and *pivots*. These terms are used throughout the sections.

Initial Scenario: Scenario and experiment plans as of December 2021, which were reported in *Deliverable 2.2*.

Revised Scenario: Scenario and experiment plans reflecting changes made to the initial scenario(s) and experiment(s) due to repeated pivots and/or participant feedback.

New Scenario: Scenario and experiment plans developed after December 2021 that are substantially different from the initial scenario and experiment plans OR cover new topics/challenges

Successful Implementation: Experiments that yielded new and useful information about challenges faced by PwCD, innovations needed, how PwCD use existing tools, and/or new ideas for web accessibility solutions. Completion of an experiment is NOT required to be labelled as successful.

Pivots: A co-design lab session in which the plan for the experiment had to be changed during the session. A session can be labelled as successful AND contain pivots. Repeatedly making the same pivot yields revised scenario(s) and experiment(s).

Each of the following sections presents more specific scenario validation results from the four co-design labs in this order: Help & Support, Self-Development, Life Skills, and Emergencies. The sections will all follow a similar format. First, an overview of participant demographics is provided. The LIVE IT Project committed to framing its work via challenges faced by people with cognitive disabilities rather than by disability; however, people with differing disabilities face the same challenges in nuanced ways. Thus, this information is provided to aid in understanding the scenario life cycles in each of the co-design labs. Second, descriptions of context and format are provided. Third, the process for implementing, pivoting, revising, and creating new scenarios is presented. Finally, we share the challenges addressed, and not addressed, by the initial, revised, and new scenarios.

3.2.3 Help & Support Scenario Validation Results

In this section, we present data pertinent to the Help & Support scenario validation. Figure 12 and Figure 13 (next page) illustrate the participant demographics.

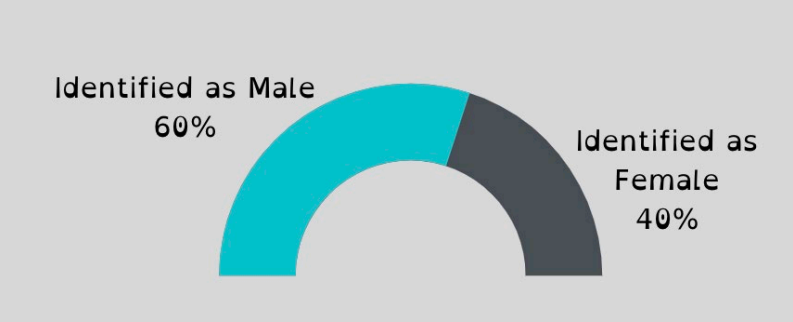


Figure 10: Help & Support Participant Demographics (Gender)

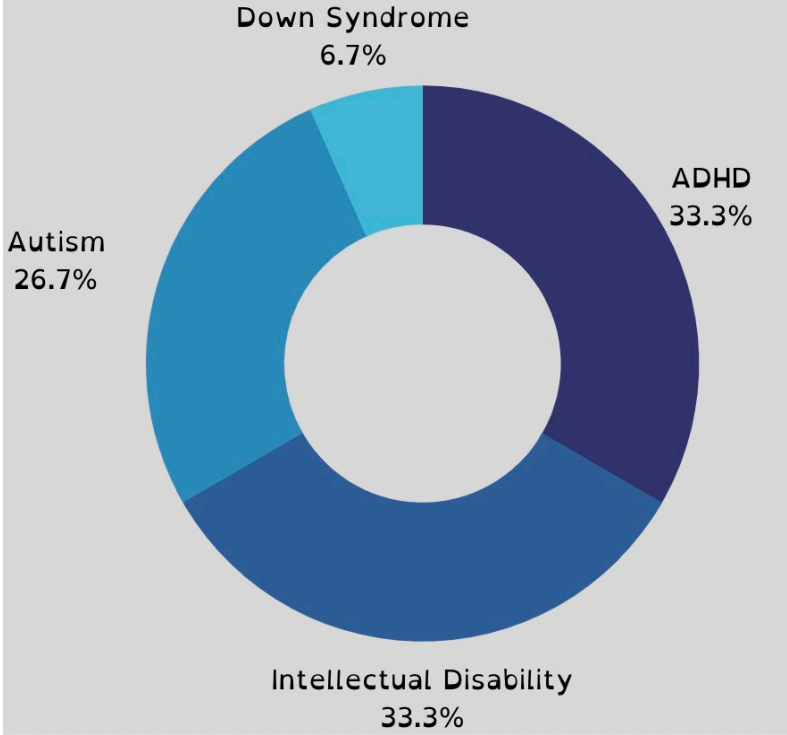


Figure 11: Help & Support Participant Demographics (Primary Disability)

Figure 14 and Figure 15 (next page) illustrate the scenario implementation process including the format for the co-design lab sessions.

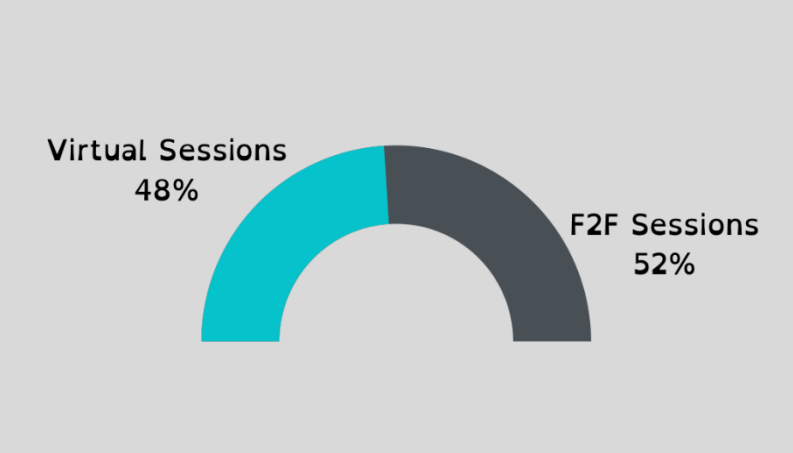


Figure 12: Help & Support Lab Session Format

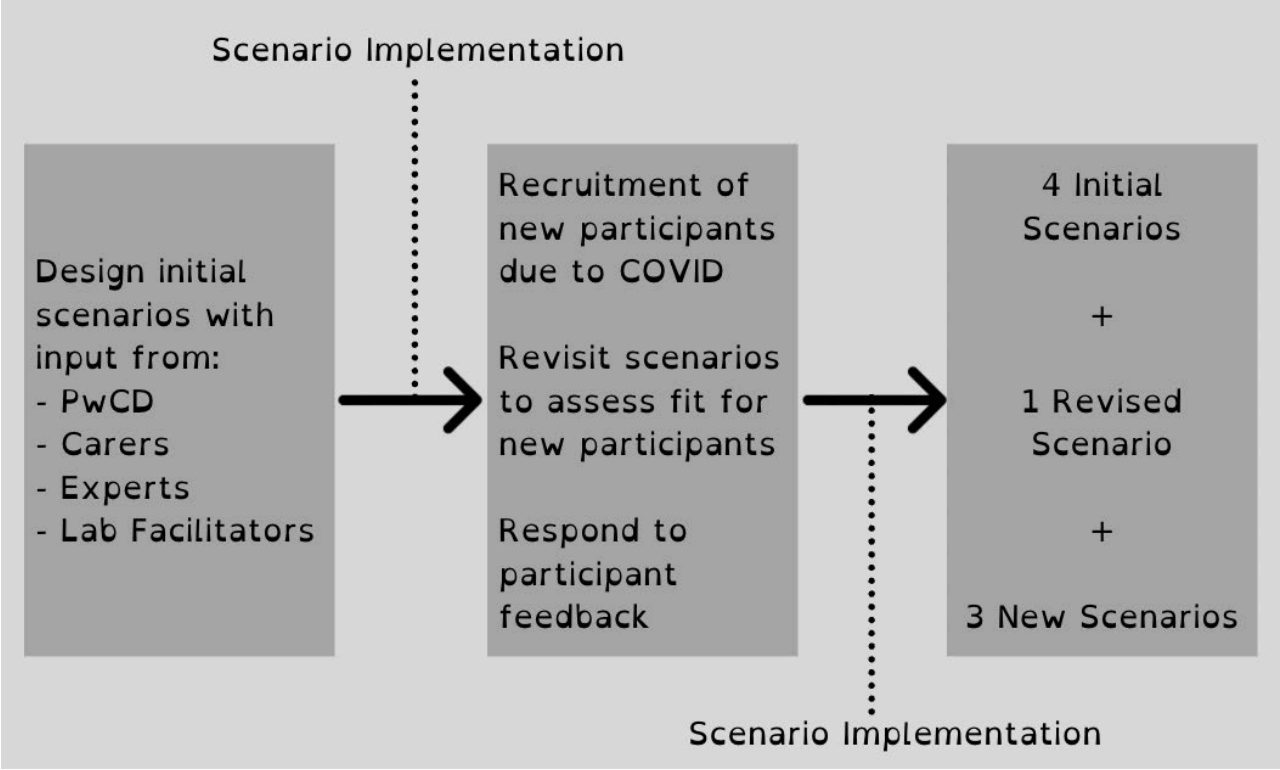


Figure 13: Help & Support Scenario Implementation Process

The Help & Support co-design lab implemented the 4 initial scenarios (see Figure 2 in Chapter 2), which subsequently led to the creation of 1 revised scenario and 3 new scenarios. A summary of the scenario implementation is provided in Tables 1-3. The tables are presented on the next 2 pages.

Table 1: Help & Support Initial Scenario Implementation

Initial Scenarios			
1) Find and use contact information	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Search for fire department phone number	10	8	3
1b) Search for police department phone number	10	8	3
1c) Search for ambulance phone number	10	8	3
1d) Search for correct contact information for a service or business	10	5	7
1e) Search for relative's phone number and send a text or a voice message about an emergency	10	5	7
2) Find an overnight pharmacy	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Search for clinics and pharmacies	10	6	8
2b) Search for related information/services	0	0	0
3) Navigate with Google Maps	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
3a) Use Google Maps to define a location	10	0	10
3b) Use Google Maps to plan a route	10	0	10
4) Obtain information via email exchange	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required

4a) Email question or complaint to a business/service	10	0	10
4b) Email a reply	10	0	10

Table 2: Help & Support Revised Scenario Implementation

Revised Scenario			
1) Obtain information via email exchange	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Send message via email and social media	5	5	0

Table 3: Help & Support New Scenario Implementation

New Scenarios			
1) Find information online	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Search for information about favourite musician	1	1	0
1b) Search for information on security issues	0	0	0
1c) Search for information to plan a vacation	5	5	0
2) Find COVID-19 information online and share with others	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Write an email about COVID-19 protective measures	5	5	0
2b) Create a powerpoint presentation about COVID-19 protective measures	5	5	4

3) Organise and plan using online tools	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
3a) Transfer homework online and use digital tools to organise	1	1	0
3b) Make a plan for the week using digital tools	5	5	3

As is shown in Figure 16, the initial, revised, and new scenarios addressed 10 of the 14 web accessibility challenges identified by the LIVE IT Project proposal.

Challenge	Challenge Addressed?
1. Signing in or completing authentication processes	✗
2. Entering data or filling out forms, avoiding and correcting errors	✓
3. Accomplishing multi-stage tasks	✓
4. Using complex interfaces and intricate navigation patterns	✓
5. Processing information on cluttered pages, avoiding cognitive overload	✓
6. Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content;	✓
7. Stopping animations and auto-play videos or audios	✗
8. Understanding text and graphics	✓
9. Identifying key points from lengthy or heavy text based pages	✓
10. Interpreting and processing numerical information, including managing dates	✗
11. Finding information	✓
12. Following instructions	✓
13. Looking for help or support	✓
14. Using web authoring tools to create content	✗

Figure 14: Challenges Addressed by Help & Support Scenarios

Additionally, the initial, revised and new scenarios allowed the Help & Support co-design lab used a total of 20 different tools with participants with cognitive disabilities:

- Microsoft Speech to text converter
- TextfromToSpeech
- Google Chrome
- Coloradd-color identification
- Autocrorrect Windows 10
- Visual Keyboard
- My access Angel
- ContrastChecker
- Microsoft Edge
- YouTube
- TextfromtoSpeech
- NVDA
- Google Calendar
- Microsoft To Do List
- Microsoft Whiteboard
- Grammarly
- Minimal Consent
- Cookie Notice Blocker
- Microsoft Word
- Microsoft Notepad
- Microsoft Word Dictation and Read-Aloud
- LIVE IT Open Toolkit

3.2.4 Self-Development Scenario Validation Results

In this section, we present data pertinent to the Self-Development scenario validation. Figure 17 and Figure 18 illustrate the participant demographics.

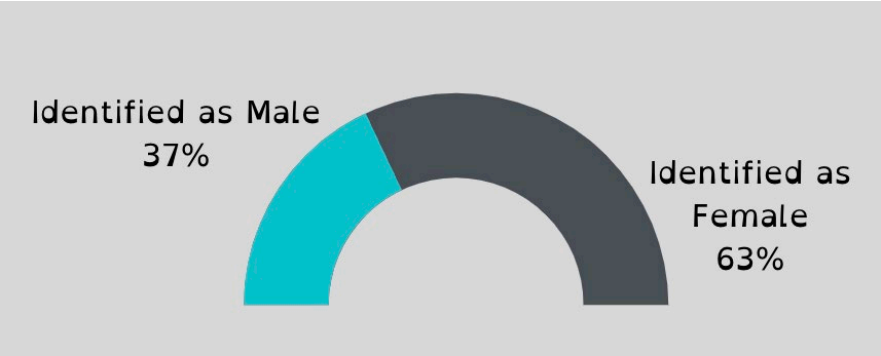


Figure 15: Self-Development Participant Demographics (Gender)

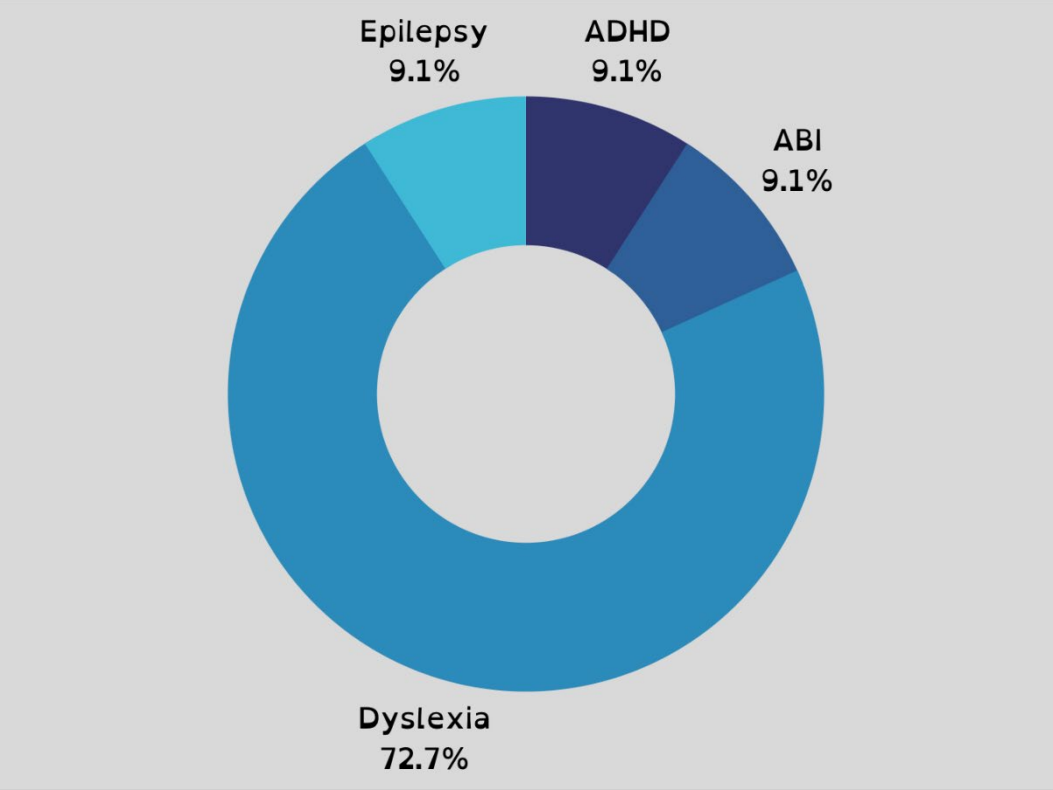


Figure 16: Self-Development Participant Demographics (Primary Disability)

Figure 19 and Figure 20 illustrate the scenario implementation process including the format for the co-design lab sessions.

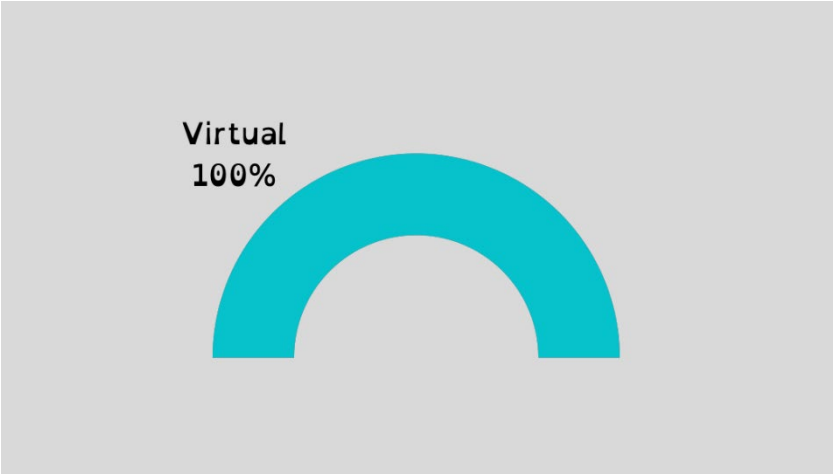


Figure 17: Self-Development Lab Session Format

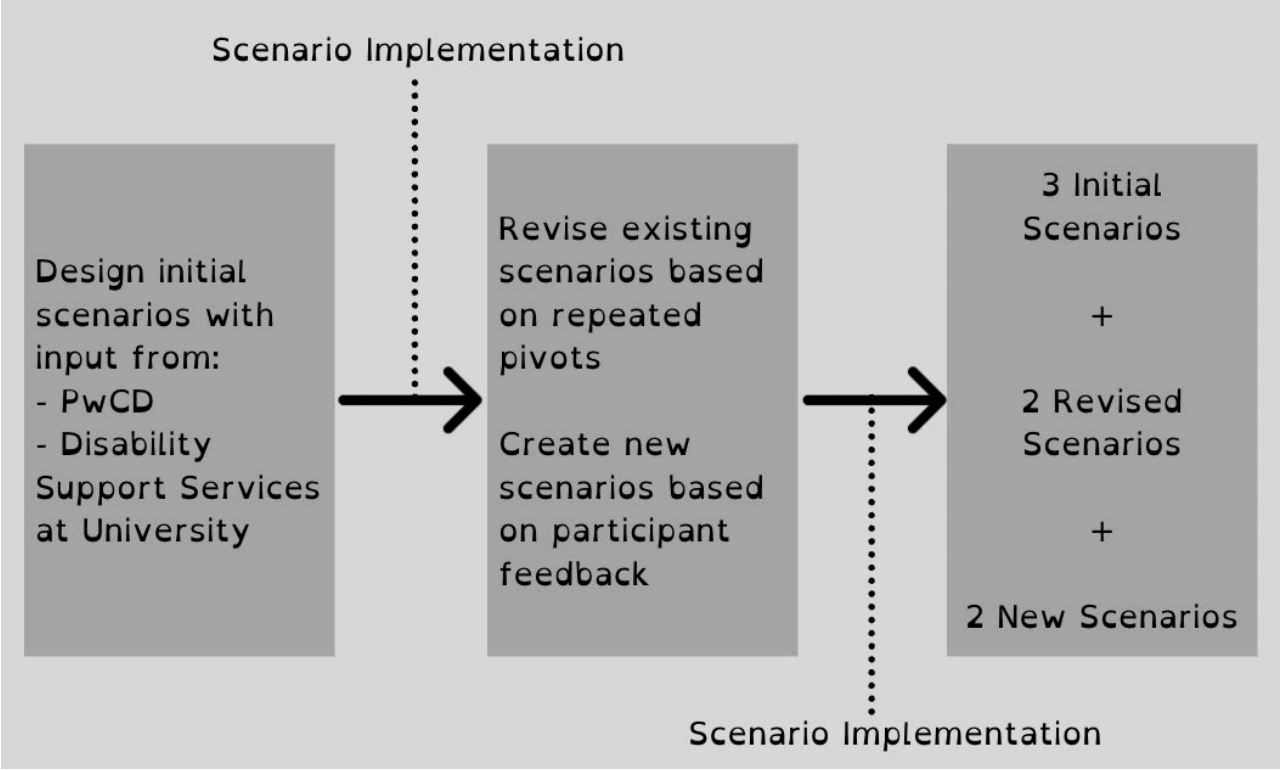


Figure 18: Self-Development Scenario Implementation Process

The Self-Development co-design lab implemented the 3 initial scenarios (see Figure 3 in Chapter 2), which subsequently led to the creation of 2 revised scenario and 2 new scenarios. A summary of the scenario implementation is provided in Tables 4-6. Table 4 is displayed on this page. Tables 5 and 6 are displayed on the next page.

Table 4: Self-Development Initial Scenario Implementation

Initial Scenarios			
1) Reading	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Use T2S tools (participant directed)	7	5	0
1b) Use T2S tools with assigned readings	7	5	3
2) Writing (via dictation)	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Use dictation/S2T to write an email	0	0	0
2b) Use dictation/S2T to write an essay (or other written assignment)	2	2	0
3) Writing (via typing)	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
3a) Write an email	11	11	2
3b) Write an essay (or other written assignment)	11	11	3

Table 5: Self-Development Revised Scenario Implementation

Revised Scenarios			
1) Reading & Writing (S2T)	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Use voice memos and S2T to generate transcript of voice memo (lecture)	1	1	0
1b) Use voice memos and S2T to generate transcript of voice memo (note-to-self)	1	1	0
2) Reading & Writing (read-aloud feature)	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Review one's own writing using read-aloud	3	3	0
2b) Use read-aloud with assigned readings	1	1	0

Table 6: Self-Development New Scenario Implementation

New Scenarios			
1) Reading (finding text alternatives)	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Find video alternatives to text (for assigned readings)	2	2	0
1b) Find picture/diagram alternatives to text (for assigned readings)	2	2	0
2) Reading (changing font)	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Apply Open Dyslexic font to webpages, PDFs, and eBooks	1	1	0
2b) Use Reader View on webpages and PDFs	1	1	0

As is shown in Figure 21, the initial, revised, and new scenarios addressed 10 of the 14 web accessibility challenges identified by the LIVE IT Project proposal.

Challenge	Challenge Addressed?
1. Signing in or completing authentication processes	✗
2. Entering data or filling out forms, avoiding and correcting errors	✓
3. Accomplishing multi-stage tasks	✓
4. Using complex interfaces and intricate navigation patterns	✗
5. Processing information on cluttered pages, avoiding cognitive overload	✓
6. Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content;	✗
7. Stopping animations and auto-play videos or audios	✗
8. Understanding text and graphics	✓
9. Identifying key points from lengthy or heavy text based pages	✓
10. Interpreting and processing numerical information, including managing dates	✗
11. Finding information	✓
12. Following instructions	✓
13. Looking for help or support	✗
14. Using web authoring tools to create content	✓

Figure 19: Challenges Addressed by Self-Development Scenarios

Additionally, the initial, revised and new scenarios allowed the Self-Development co-design lab used a total of 20 different tools with participants with cognitive disabilities:

- YouTube
- Word
- Grammarly
- Google Translate
- Google
- Gmail
- Natural Readers
- Built-in T2S (Windows)
- Word Dictation
- Word Spelling & Grammar
- Texthelp Read&Write
- Google Chrome Spell Checker
- Pocket Thesaurus (android app)
- Word Read Aloud
- Built-in T2S (Chromebook)
- Open Dyslexic Font
- Microsoft Outlook
- Reader View (web extension)
- Built-in T2S (Microsoft Edge)
- LIVE IT Open Toolkit

3.2.5 Life Skills Scenario Validation Results

In this section, we present data pertinent to the Life Skills scenario validation. Figure 22 and Figure 23 illustrate the participant demographics.

Figure 20: Life Skills Participant Demographics (Gender)

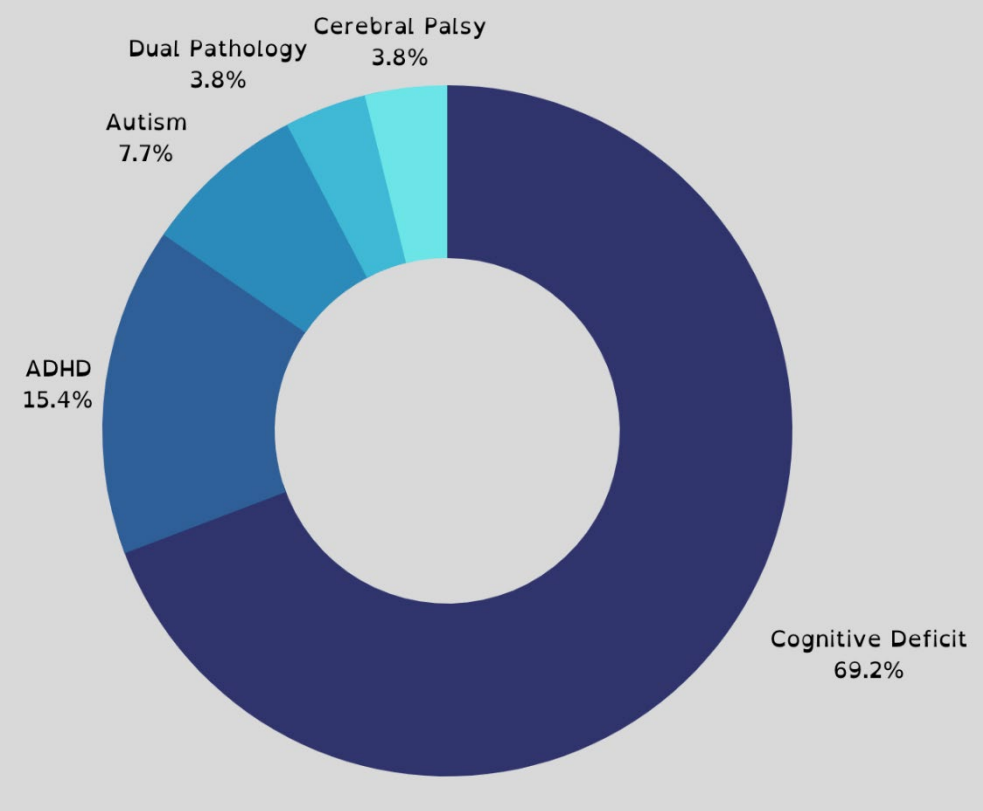


Figure 21: Life Skills Participant Demographics (Primary Disability

Figure 24 and Figure 25 illustrate the scenario implementation process including the format for the co-design lab sessions.

Figure 22: Life Skills Lab Session Format

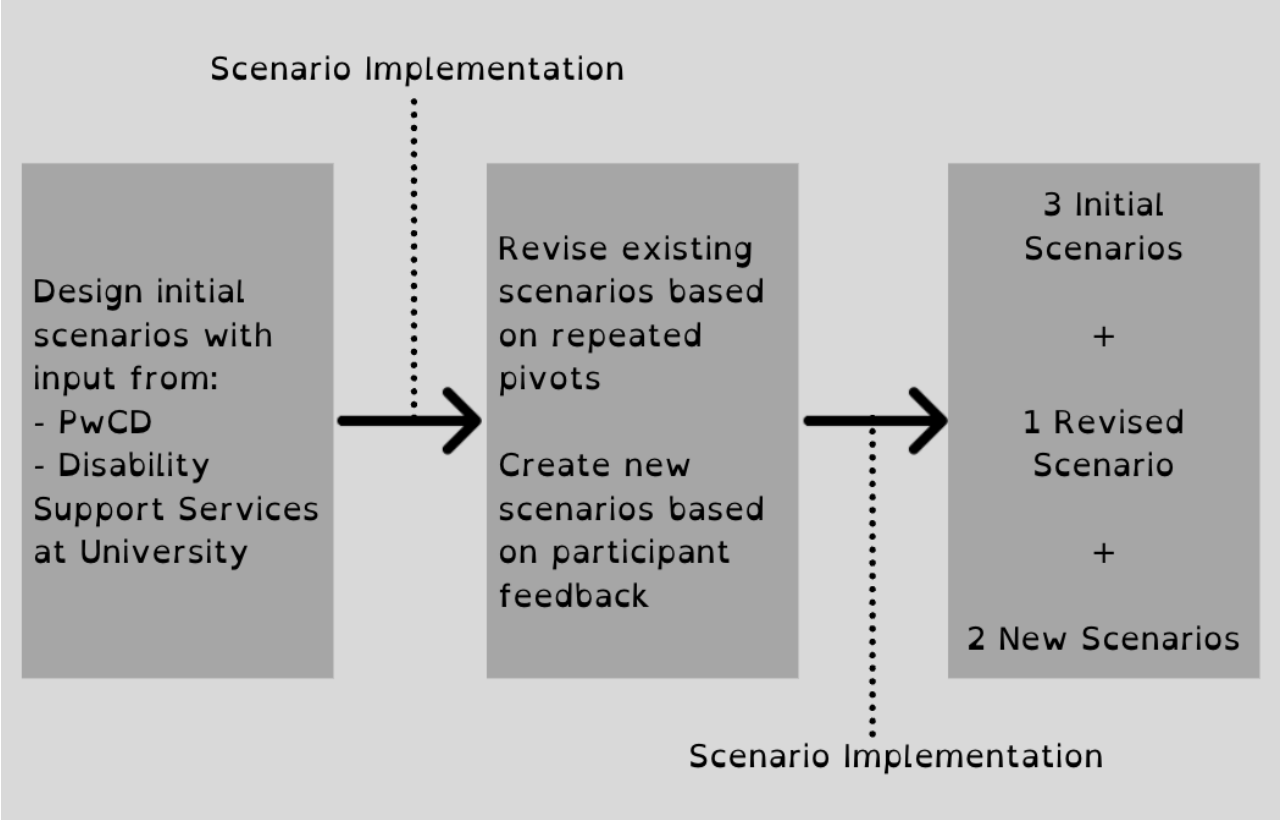


Figure 23: Life Skills Scenario Implementation Process

The Life Skills co-design lab implemented the 3 initial scenarios (see Figure 3 in Chapter 2), which subsequently led to the creation of 2 revised scenario and 2 new scenarios. A summary of the

scenario implementation is provided in Tables 7-9. Table 7 is displayed on this page. Tables 8 and 9 are displayed on the following page.

Table 7: Life Skills Initial Scenario Implementation

Initial Scenarios			
1) Text-to-speech	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Use T2S with email	10	10	5
1b) Use T2S with news websites	10	10	2
1c) Use T2S with social media feed	10	10	1
1d) Use T2S with online train schedules	5	4	0
2) Translation	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Use translation tools with email	10	10	3
2b) Use translation tools with news websites	10	10	2
2c) Use translation tools with social media feed	10	10	0
3) Complex Tasks	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
3a) Book a COVID-19 vaccination appointment	5	3	0
3b) Use 2-factor authentication	5	3	0
3c) Buy items online	2	0	0

Table 8: Life Skills Revised Scenario Implementation

Revised Scenario			
1) Complex Tasks	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Search for information online	10	10	5
1b) Record voice memos in messaging apps	3	3	0

Table 9: Life Skills New Scenario Implementation

New Scenarios			
1) Understanding and interpreting numerical, text, and graphics information	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Use a national COVID-19 statistics website	1	1	0
2) Manage dates and appointments	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Use a digital calendar to save appointments	5	5	2

As is shown in Figure 26 (next page), the initial, revised, and new scenarios addressed 10 of the 14 web accessibility challenges identified by the LIVE IT Project proposal.

Challenge	Challenge Addressed?
1. Signing in or completing authentication processes	✓
2. Entering data or filling out forms, avoiding and correcting errors	✓
3. Accomplishing multi-stage tasks	✓
4. Using complex interfaces and intricate navigation patterns	✓
5. Processing information on cluttered pages, avoiding cognitive overload	✓
6. Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content;	✗
7. Stopping animations and auto-play videos or audios	✗
8. Understanding text and graphics	✓
9. Identifying key points from lengthy or heavy text based pages	✓
10. Interpreting and processing numerical information, including managing dates	✗
11. Finding information	✓
12. Following instructions	✓
13. Looking for help or support	✗
14. Using web authoring tools to create content	✓

Figure 24: Challenges Addressed by Life Skills Scenarios

Additionally, the initial, revised and new scenarios allowed the Life Skills co-design lab used a total of 12 different tools with participants with cognitive disabilities:

- Gmail
- Google Chrome
- Microsoft Edge
- Read aloud features embedded in browser
- Browser add-on translator feature to translate text
- 2 Factor Authentication
- Facebook
- Password managers
- Ad blockers
- Total Ad Block
- Helperbird
- LIVE IT Open Toolkit

3.2.6 Emergencies Scenario Validation Results

In this section, we present data pertinent to the Emergencies scenario validation. Figure 27 and Figure 28 illustrate the participant demographics.

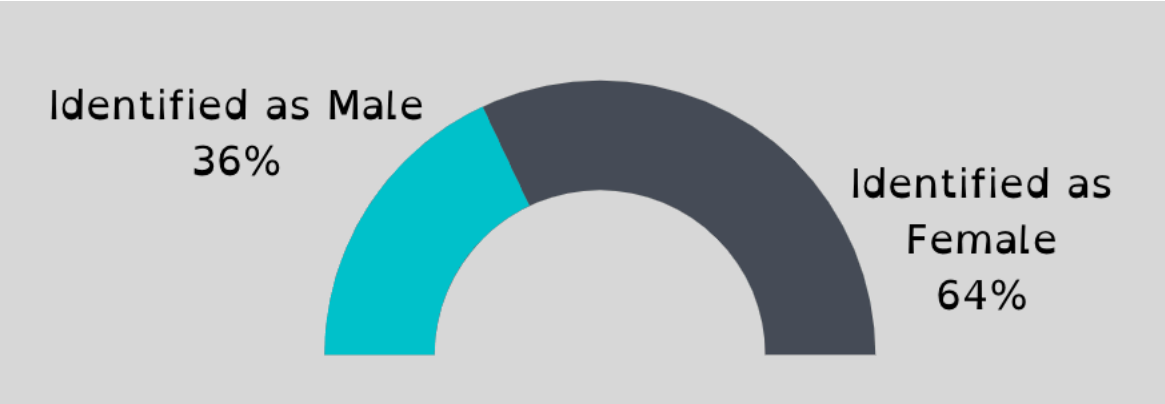


Figure 25: Emergencies Participant Demographics (Gender)

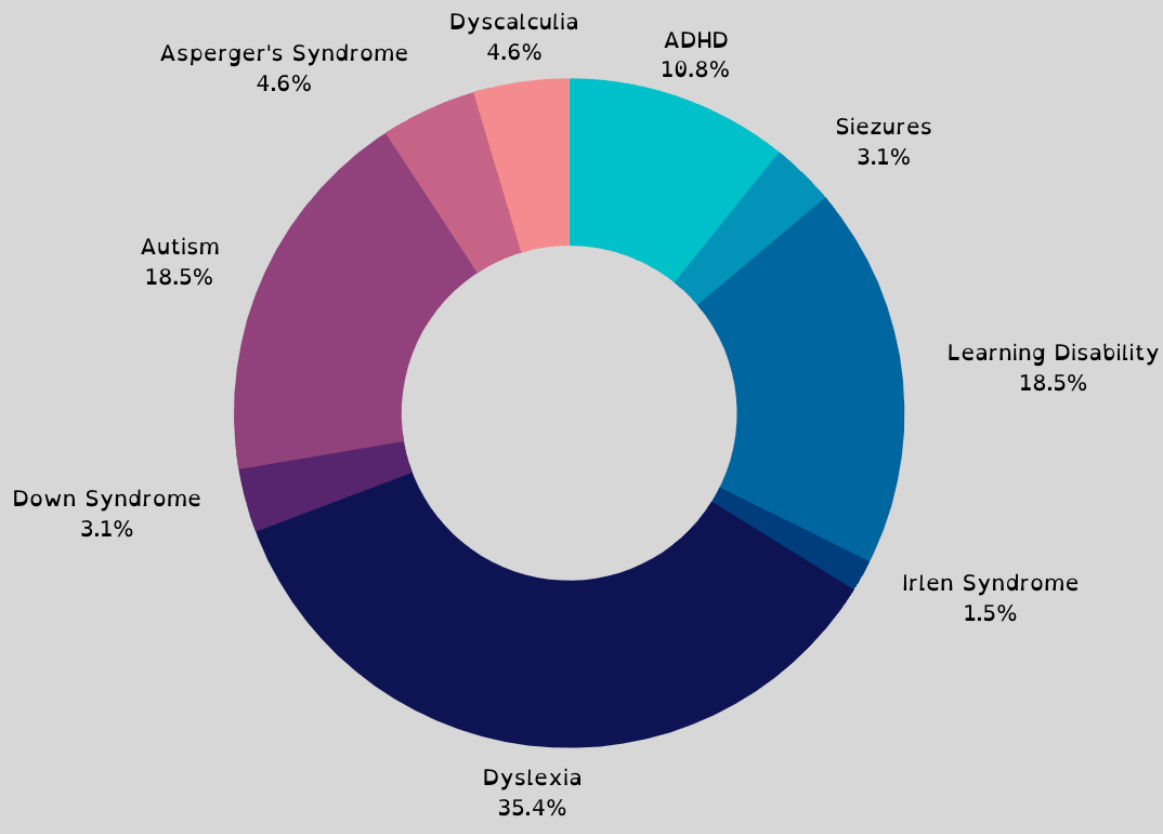


Figure 26: Emergencies Participant Demographics (Primary Disability)

Figure 29 and Figure 30 illustrate the scenario implementation process including the format for the co-design lab sessions.

Figure 27: Emergencies Lab Session Format

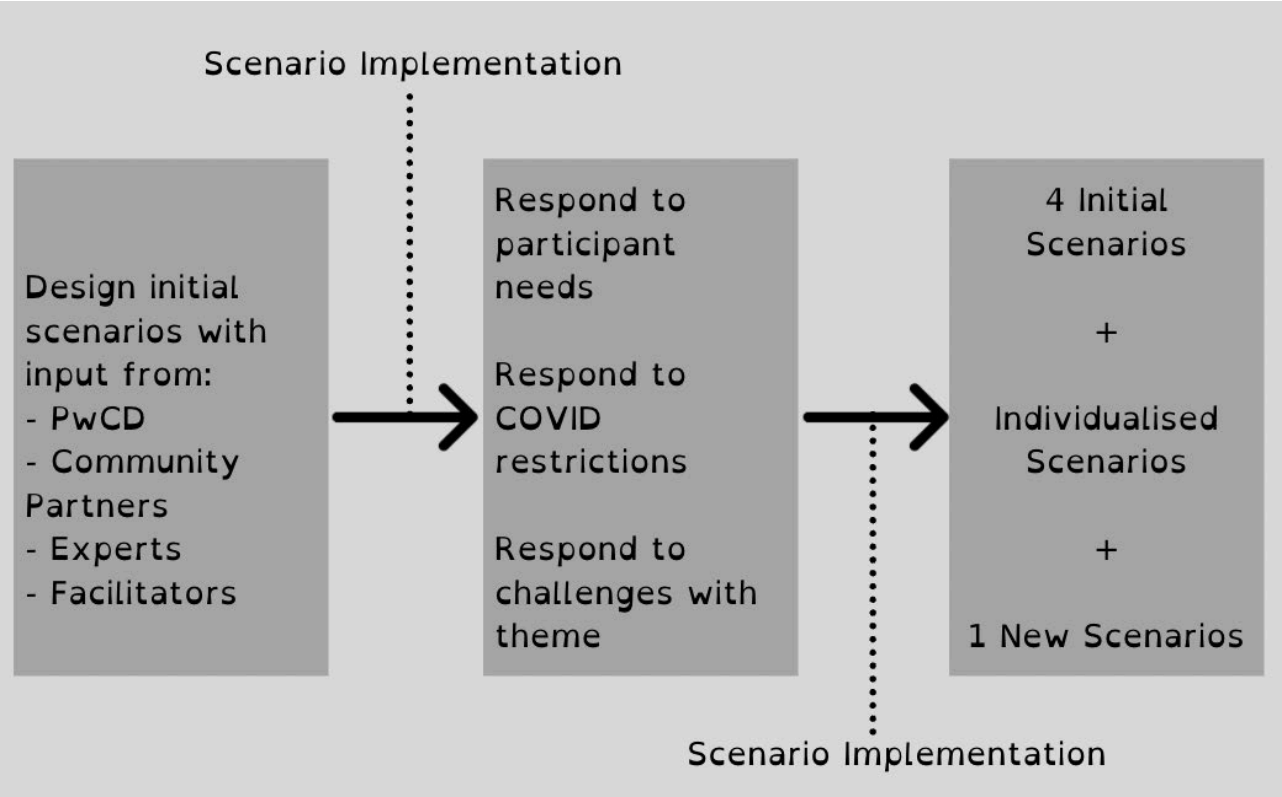


Figure 28: Emergencies Scenario Implementation Process

It should be noted that the theme of "emergencies" caused substantial issues when running through scenarios with participants, because the theme inherently evokes negative emotions such as stress and overwhelm. The co-design lab facilitators made necessary pivots during nearly all

sessions with participants. However, nearly all sessions yielded information that supports the continued improvement of web accessibility.

The Emergencies co-design lab implemented the 4 initial scenarios (see Figure 4 in Chapter 2), which subsequently led to the creation of multiple individualised scenarios and 1 new scenario. A summary of the scenario implementation is provided in Tables 10-12 which are displayed on the next 2 pages.

Table 10: Emergencies Initial Scenario Implementation

Initial Scenarios			
1) Finding help in an emergency	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Use video-based tools to find help	2	2	2
1b) Use image-based tools to find help	3	2	3
1c) Use T2S tools to find help	12	6	6
1d) Use S2T tools (on forms) to find help	12	6	6
1e) Use S2T tools (messages) to find help	4	2	2
1f) Use apps to find help	2	2	0
1g) Connect with others to find help and support	3	3	0
2) Preparing for an emergency	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
2a) Use video-based tools to prepare	2	2	0
2b) Use image-based tools to prepare	0	0	0
2c) Use T2S tools to prepare	4	2	2
2d) Create personal memos to prepare	1	1	0
2e) Use note-taking and mind-mapping tools to prepare	3	1	2
3) What to do in an emergency	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
3a) Use video-based tools to learn what to do	5	5	4
3b) Use image-based tools to learn what to do	3	4	3

3c) Use T2S tools to learn what to do	5	5	2
4) Optimise phone for use	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
4a) Learn how to do user-friendly device set-up	4	4	2

Table 11: Emergencies Revised Scenario Implementation

Revised Scenario(s)			
1) Individualised	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Participant-directed	7	7	7

Table 12: Emergencies New Scenario Implementation

New Scenario			
1) Managing healthcare	Number of times used in co-lab	Number of successful implementations	Number of implementations with pivots required
1a) Managing healthcare via apps	4	2	2
1b) Managing mental health and well-being	4	2	2

As is shown in Figure 35 (next page), the initial, revised, and new scenarios addressed 10 of the 14 web accessibility challenges identified by the LIVE IT Project proposal.

Challenge	Challenge Addressed?
1. Signing in or completing authentication processes	✓
2. Entering data or filling out forms, avoiding and correcting errors	✓
3. Accomplishing multi-stage tasks	✓
4. Using complex interfaces and intricate navigation patterns	✓
5. Processing information on cluttered pages, avoiding cognitive overload	✓
6. Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content;	✓
7. Stopping animations and auto-play videos or audios	✓
8. Understanding text and graphics	✓
9. Identifying key points from lengthy or heavy text based pages	✓
10. Interpreting and processing numerical information, including managing dates	✗
11. Finding information	✓
12. Following instructions	✓
13. Looking for help or support	✓
14. Using web authoring tools to create content	✗

Figure 29: Challenges Addressed by Emergencies Scenarios

Additionally, the initial, revised and new scenarios allowed the Emergencies co-design lab used a minimum of 63 different tools with participants with cognitive disabilities:

- Text to speech
- Microsoft Office tools
- inbuilt T2S for Android, iOS, and Microsoft
- Read&Write
- Claroread
- Dragon
- Grammarly Pro
- Predictive text (Android)
- Predictive text (Ipad)
- TextHelp
- S2T (Google)
- S2T (Apple)
- S2T (Microsoft)
- S2T (Android)
- What3Words
- Easy Reading
- TikTok
- Chrome
- Firefox
- Google
- Instagram
- YouTube
- Mimind
- Siri (multiple features)
- Google Calender
- Purple overlay
- Spidergrams
- Snap and Read
- WebHelp Dyslexia
- Voice Search -Google and YouTube
- Wikipedia
- Dictation (Apple)
- Dictation (Microsoft)
- Chrome

- Edge
- NVDA
- PowerPoint
- Voice Aloud Reader
- Assistive Touch on the iPad
- Assistive Touch on the Android tablet
- Google Voice Typing via keyboard
- IPad Keyboard Microphone
- ReadBit
- Natural Readers Chrome Extension
- Android: Speechify
- Android Accessibility Suite: Talkback
- Android Accessibility Suite: visibility enhancements
- Android: CBoard
- Microsoft Windows Computer: Speechify
- Google Chrome extension: Read Aloud a Text to Speech Voice Reader
- iPad: ReadBit
- iPad: Text to Speech
- iPad: Dolphin EasyReader
- SpeechTexter
- Google Assistant - Android
- Lucipspark Microsoft computer
- Sticky Notes Microsoft Computer
- Lucidspark - microsoft desktop

4 SCENARIOS FOR ALL

This section lists the procedures for all LIVE IT Project scenarios validated in this report. The scenarios are grouped by co-design lab with notes about whether the scenario is an original, revised, or new scenario included throughout. All alphanumeric labels in the headings are the same as in the tables earlier in the report. Scenarios that were not ultimately used in labs are not included in this section because they were not validated through use.

We list the scenarios by Co-Lab. The order is the same in this chapter as in the other sections of this report. First, we present the Help & Support scenarios. Second, we present the Self-Development scenarios. Third, we present the Life Skills scenarios. Fourth, we present the Emergencies scenarios.

The procedures presented here represent the procedures that were validated with PwCD through Co-Lab implementation. We recommend using these procedures as a guide rather than a strict set of rules to follow. Practice procedural flexibility when implementing these scenarios so that you meet the needs of the PwCD co-designing with you In your context. Additionally, the tools presented here are the tools that were used in the Co-Lab sessions. This is not a comprehensive list of all available tools. Rather it is a record of what was used to guide tool selection for future research.

4.1 HELP & SUPPORT

The following sections describe the procedures for the validated Help & Support scenarios.

Figure 30: Help & Support Validated Scenarios

4.1.1 Original Scenarios

4.1.1.1 Original Scenario 1a: Search for Fire Department Phone Number

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)

- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose from the search results

4.1.1.2 Original Scenario 1b: Search for Police Department Phone Number

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose from the search results

4.1.1.3 Original Scenario 1c: Search for Ambulance Phone Number

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose from the search results

4.1.1.4 Original Scenario 1d: Find and Use Contact Information for a Service or Business

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose from the search results

4.1.1.5 Original Scenario 1e: Search for and Use a Relative's Phone Number

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (mobile phone)
- Communication Apps (WhatsApp, Viber, Skype, Messenger)

Equipment Needed for Task/Activity:

- Device (mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Search for contacts using mobile phone (either in phone contacts or within app contacts)
- Send a voice message to a contact

4.1.1.6 Original Scenario 2a: Search for Clinics and Pharmacies

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information

- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose from the search results

4.1.1.7 Original Scenario 2b: Search for Pharmacy Information and Services

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose from the search results

4.1.1.8 Original Scenario 3a: Use Google Maps to Define a Location

Challenge(s) Potentially Addressed:

- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Google Maps

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to Google Maps in the way that makes most sense for the device in use (website or app version can be used)
- Use the button for finding your current location (may need to turn on permissions for location use)
- Type in address
- Use dictation to enter address
- View the location on the map and define the location
- Use Google Maps to find services in the nearby area

4.1.1.9 Original Scenario 3b: Use Google Maps to Plan a Route

Challenge(s) Potentially Addressed:

- Entering data or filling out forms, avoiding and correcting errors

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Google Maps

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to Google Maps in the way that makes most sense for the device in use (website or app version can be used)
- Use the method that makes most sense for the participant to enter current location
- Use the method that makes most sense for the participant to enter destination address
- Select the type of transportation (i.e., cycle, car, or bus/train)
- Select a route

4.1.1.10 Original Scenario 4a: Email a Question or Complaint to a Service or Business

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Accomplishing multi-stage tasks
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)
- Word Processor (Word, Google Docs, Notes)
- Email App (Outlook, Gmail)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser or app and login to email
- Open a word processor and compose the email text (if needed; it is possible to compose within email)
- Review the email text to ensure it includes: name, reason for writing the email, statement of problem or question, appropriate contact information
- Search for the service or business email address
- Enter email address, subject, email text and send the email

4.1.1.11 Original Scenario 4b: Email a Reply

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Accomplishing multi-stage tasks
- Finding information
- Following instructions

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)
- Word Processor (Word, Google Docs, Notes)
- Email App (Outlook, Gmail)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser or app and login to email
- Check for new emails

- Locate the service or business response, open it, and read it
- Identify the answer provided and decide whether the answer is sufficient
- Compose and send an appropriate reply

4.1.2 Revised Scenarios

4.1.2.1 Revised Scenario 1: Send a Message Using Email and Social Media

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Accomplishing multi-stage tasks
- Finding information
- Following instructions

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Social Media App (Messenger, WhatsApp, Instagram, Snapchat)
- Email App (Outlook, Gmail)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open the desired app or navigate to the desired website for sending the message
- Find the desired contact and start a new chat
- Type the message or use a voice message (if permitted in the app chosen)
- Send the message
- Reply as appropriate

4.1.3 New Scenarios

4.1.3.1 New Scenario 1a: Search for Information about Favourite Musician

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload

- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content;
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Finding information
- Following instructions

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser
- Develop and use search terms
- Choose websites to explore from the search results
- Keep notes of the important information

4.1.3.2 New Scenario 1c: Search for Information to Plan a Vacation

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Finding information
- Following instructions

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)
- Google Maps

- Communication App (Messenger, WhatsApp, Viber)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser or the appropriate app
- Search locations for a vacation
- Navigate to the map that appears in search results (if not already in Google Maps)
- Search for hotels, restaurants, attractions near your destination
- Compose a message about what you planned
- Send the message to a contact

4.1.3.3 New Scenario 2a: Write an Email about COVID19 Protective Measures

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content;
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)
- Email (Outlook, Gmail)
- Communication App (WhatsApp, Messenger, Viber)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser or the appropriate app
- Start an email thread or open a chat with a contact using one of the messaging apps
- Develop and use appropriate search terms
- Choose from search results
- Open the chosen webpages
- Write an email or a message to a family member or friend using the information found on the websites

4.1.3.4 New Scenario 2b: Create a PowerPoint Presentation about COVID19 Protective Measures

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content;
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Finding information
- Following instructions
- Looking for help or support

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)
- Email (Outlook, Gmail)
- PowerPoint

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol

- User Survey

Procedural Instructions:

- Open a browser or the appropriate app
- Develop and use appropriate search terms
- Choose from search results
- Open the chosen webpages
- Make a PowerPoint presentation using the information found on the chosen webpages

4.1.3.5 New Scenario 3a: Transfer Homework Online and Use Digital Tools to Organise

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content;
- Finding information
- Following instructions

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Search App (Google)
- School Platform (such as Canvas, Blackboard, or Moodle)
- Apps (Word, Excel, Google Docs, Google Sheets, etc…)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Find homework assignments
- Select appropriate apps for homework assignments
- Transfer homework to a digital format
- Save, sort, and organize digital homework files

4.1.3.6 New Scenario 3b: Make a Plan for the Week Using Digital Tools

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Finding information
- Following instructions

Tool(s):

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Calendar App (Google Calendar)
- Organizer Apps (Microsoft To-Do List, Task and Reminder, Microsoft Whiteboard, Microsoft Word (including Microsoft Notepad, Read Aloud, Microsoft Word dictation)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open a browser or the appropriate calendar app
- Open or find a time management/organizer app
- Make a list of the tasks you would like to do or need to do in the next week
- Use the list to enter items in the calendar and/or time-management/organizer apps

4.2 SELF-DEVELOPMENT

The following sections describe the validated Self-Development scenarios.

Figure 31: Self-Development Validated Scenarios

4.2.1 Original Scenarios

4.2.1.1 Original Scenario 1a: Use T2S Tools (Participant Directed)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks

- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Built-In Text-to-Speech (Microsoft, Apple, Android)
- Texthelp Read & Write
- Natural Readers
- Microsoft Word Read Aloud

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use T2S tools in daily activities

4.2.1.2 Original Scenario 1b: Use T2S Tools with Assigned Readings

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text based pages
- Interpreting and processing numerical information, including managing dates

- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Built-In Text-to-Speech (Microsoft, Apple, Android)
- Texthelp Read & Write
- Natural Readers
- Microsoft Word Read Aloud

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use T2S tools with assigned readings

4.2.1.3 Original Scenario 2b: Use Dictation/S2T to Write an Essay (or Other Written Assignment)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word Dictation

- Otter
- Voice notes app of choice
- Grammarly
- Microsoft Word Spelling and Grammar Check
- Microsoft Word Read Aloud

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use S2T/dictation tools to complete writing assignments

4.2.1.4 Original Scenario 3a: Write an Email

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word (Dictation, Read Aloud, Spelling & Grammar Checker)
- Grammarly
- Email Site/App (Outlook, Gmail)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use their preferred tools to write emails

4.2.1.5 Original Scenario 3b: Write an Essay (or Other Written Assignment)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word (Dictation, Read Aloud, Spelling & Grammar Checker)
- Grammarly
- Email Site/App (Outlook, Gmail)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session

- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use their preferred tools to write assignments/essays

4.2.2 Revised Scenarios

4.2.2.1 Revised Scenario 1a: Use Voice Memos and S2T to Generate Transcript of Voice Memos (Lecture)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word Dictation
- Otter
- Voice notes app of choice

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use S2T/dictation tools with lecture videos/recordings

4.2.2.2 Revised Scenario 1b: Use Voice Memos and S2T to Generate Transcript of Voice Memos (Note-to-Self)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word Dictation
- Otter
- Voice notes app of choice

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use S2T/dictation tools to make notes-to-self

4.2.2.3 Revised Scenario 2a: Review One's Own Writing Using Read-Aloud Feature

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload

- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word Dictation
- Grammarly
- Microsoft Word Spelling and Grammar Check
- Microsoft Word Read Aloud

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use read aloud feature to review their own writing

Procedural Instructions:

4.2.2.4 Revised Scenario 2b: Use Read-Aloud Feature with Assigned Readings

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages

- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Microsoft Word Read Aloud

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use read aloud feature to complete assigned readings

4.2.3 New Scenarios

4.2.3.1 New Scenario 1a: Find Video Alternatives to Text (for Assigned Readings)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Google

- YouTube

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they search for and use video resources to assist in completing assigned readings

4.2.3.2 New Scenario 1b: Find Picture/Diagram Alternatives to Text (for Assigned Readings)

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Google

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they search for and use images to assist in completing assigned readings

4.2.3.3 New Scenario 2a: Apply Open Dyslexic Font to Webpages, PDFs, and eBooks

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Open Dyslexic Font

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use Open Dyslexic font

4.2.3.4 New Scenario 2b: Use Reader View on Webpages and PDFs

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, mobile phone)
- Reader View Extension

Equipment Needed for Task/Activity:

- Device (laptop, tablet, mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Participants complete the user survey prior to the session
- Session begins by asking participants to explain their survey responses
- Prompt participants to demonstrate features, benefits, and challenges of the tools they use
- Prompt participants to show how they use Reader View

4.3 LIFE SKILLS

The following sections describe the validated Life Skills scenarios.

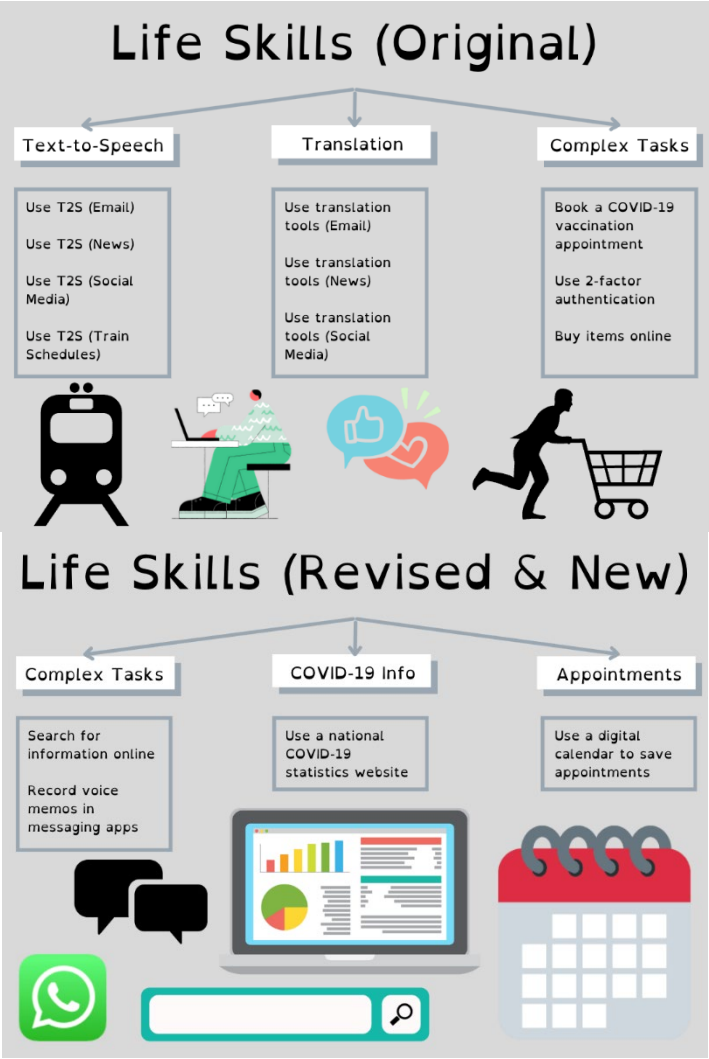


Figure 32: Life Skills Validated Scenarios

4.3.1 Original Scenarios

4.3.1.1 Original Scenario 1a: Use T2S with Email

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors

- Accomplishing multi-stage tasks
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Gmail
- Built-in Text-to-Speech (device)
- Text-to-Speech (browser)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open browser and sign into Gmail
- Use keyboard command (ctrl+shift+u) to activate the text-to-speech
- Listen to the email
- Compose a reply to the email
- Open an email
- Prompt the participant to think-aloud throughout the process of reading the initial email and composing a reply

4.3.1.2 Original Scenario 1b: Use T2S with News Websites

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates

- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Built-in Text-to-Speech (device)
- Text-to-Speech (browser)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to one of several pre-selected news websites
- Use keyboard command (ctrl+shift+u) to activate the text-to-speech
- Use the text-to-speech feature on mobile phone
- Repeat for additional webpages
- Prompt the participant to think-aloud throughout the process of reading the webpages

4.3.1.3 Original Scenario 1c: Use T2S with Social Media Feed

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)

- Browser (Microsoft Edge, Google Chrome)
- Built-in Text-to-Speech (device)
- Text-to-Speech (browser)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to one of several pre-selected social media sites or apps
- Use keyboard command (ctrl+shift+u) to activate the text-to-speech
- Use the text-to-speech feature on mobile phone
- Repeat for additional social media sites or apps
- Prompt the participant to think-aloud throughout the process of reading items on the news feeds

4.3.1.4 Original Scenario 1d: Use T2S with Online Train Schedules

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Built-in Text-to-Speech (device)
- Text-to-Speech (browser)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to one of several pre-selected transit websites and find a train schedule
- Use keyboard command (ctrl+shift+u) to activate the text-to-speech
- Use the text-to-speech feature on mobile phone
- Repeat for additional train schedules
- Prompt the participant to think-aloud throughout the process of reading the train schedules

4.3.1.5 Original Scenario 2a: Use Translation Tools with Email

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Gmail
- Browser translator add-on

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Open browser and sign into Gmail

- Open an email
- Use the browser's translator add-on to translate the email
- Read the email
- Compose a reply to the email
- Prompt the participant to think-aloud throughout the process of reading the initial email and composing a reply

4.3.1.6 Original Scenario 2b: Use Translation Tools with News Websites

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Browser translator add-on

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to one of several pre-selected news websites
- Use the browser's translator add-on to translate the webpage
- Repeat for additional webpages
- Prompt the participant to think-aloud throughout the process of reading the webpages

4.3.1.7 Original Scenario 2c: Use Translation Tools with Social Media Feed

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Browser translator add-on

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to one of several pre-selected social media sites or apps
- Use the browser's translator add-on to translate the page
- Repeat for additional social media sites or apps
- Prompt the participant to think-aloud throughout the process of reading items on the news feeds

4.3.1.8 Original Scenario 3a: Book a COVID19 Vaccination Appointment

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Looking for help or support
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to the COVID-19 Vaccination website
- Fill in associated online forms with personal details
- Receive and confirm authentication code through SMS
- Prompt participant to think aloud through the process of filling out the forms and authentication

4.3.1.9 Original Scenario 3b: Use 2-Factor Authentication

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload

- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Looking for help or support
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to the national health website and access personal profile
- Receive and confirm authentication code through SMS
- Navigate to emergency contacts' section
- Fill in associated online forms with contact information
- Prompt participant to think aloud through the process of filling out the forms and authentication

4.3.1.10 Original Scenario 3c: Buy Items Online

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics

- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Looking for help or support
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected supermarket website
- Add 1kg oranges, 1 box of hamburgers, and a pack of 4 yoghurts to basket
- Checkout and fill in delivery details
- Prompt participant to think aloud through the process of adding items to basket, checking out, and filling in delivery details

4.3.2 Revised Scenarios

4.3.2.1 Revised Scenario 1a: Search for Information Online

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to a search engine
- Develop and use search terms
- Choose from the search results
- Prompt participant to think aloud through the process of searching for and selecting information

4.3.2.2 Revised Scenario 1b: Record Voice Memos in Messaging App

Challenge(s) Potentially Addressed:

- Signing in or completing authentication processes
- Accomplishing multi-stage tasks
- Finding information
- Looking for help or support
- Following instructions

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Communication App (Messenger, WhatsApp, etc…)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to the appropriate website or app (likely to be using app on phone or tablet)
- Compose and send a voice message using a messaging app
- Repeat for other messaging app(s) as needed

- Prompt the participant to think aloud through the process of composing and sending the voice message(s)

4.3.3 New Scenarios

4.3.3.1 New Scenario 1: Use National COVID19 Statistics Website

Challenge(s) Potentially Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Identifying key points from lengthy or heavy text-based pages
- Interpreting and processing numerical information, including managing dates
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Built in Text-to-Speech (device)
- Browser Text-to-Speech
- Browser translator add-on

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to one of several pre-selected national data dashboards for COVID-19
- Explore the data dashboard
- Use translator and text-to-speech tools as needed
- Use additional tools as needed
- Prompt the participant to think aloud through the process of using the accessibility tools with the national statistics website

4.4 EMERGENCIES

The following sections describe the validated Emergencies scenarios.

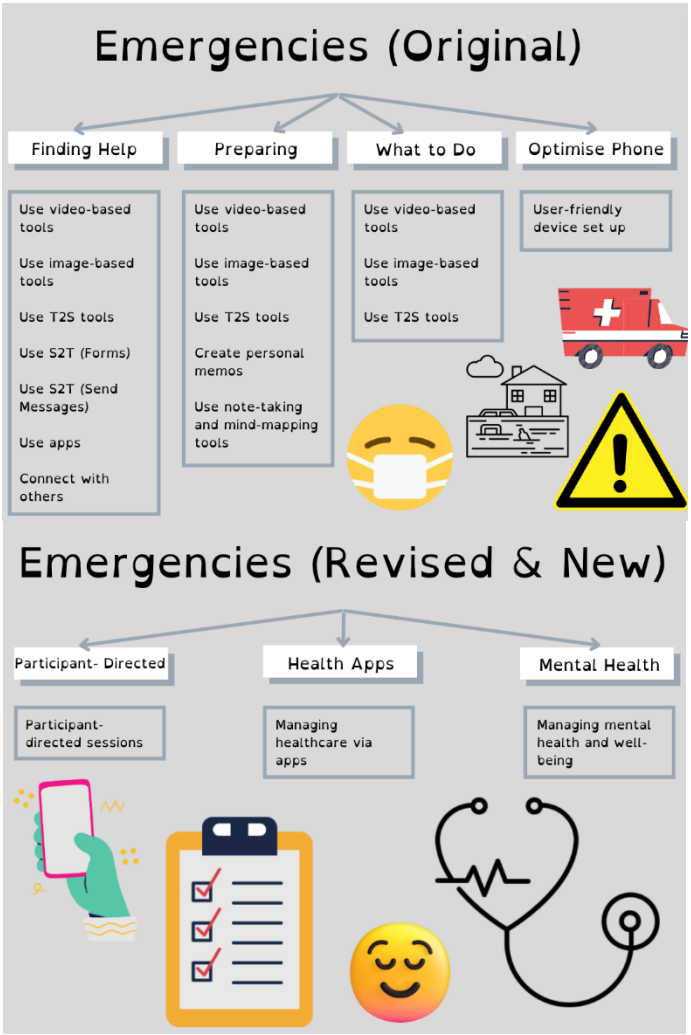


Figure 33: Emergencies Validated Scenarios

4.4.1 Original Scenarios

4.4.1.1 Original Scenario 1a: Use Video-Based Tools to Find Help

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns

- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - YouTube
    - TikTok
    - Vimeo
- **iPad:**
    - YouTube
    - TikTok
    - Vimeo
- **Microsoft Windows:**
    - YouTube
    - TikTok
    - Vimeo
    - YiNote

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected video about asking for help/finding help during an emergency using via apps or a web browser
- Repeat as needed for additional videos
- Prompt participant to think aloud during the process of finding and viewing the videos

4.4.1.2 Original Scenario 1b: Use Image-Based Tools to Find Help

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Instagram
- **iPad:**
    - Instagram
- **Microsoft Windows:**
    - Instagram

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected Instagram posts about asking for help/finding help during an emergency using via apps or a web browser
- Repeat as needed for additional Instagram posts
- Prompt participant to think aloud during the process of finding and viewing the Instagram posts

4.4.1.3 Original Scenario 1c: Use T2S Tools to Find Help

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Dolphin Easy Reader
    - Texthelp: Read & Write
    - Android Accessibility Suite
    - IDEAL Group Reader
    - CBoard
    - Speechify
- **iPad:**
    - Dolphin Easy Reader
    - Texthelp: Read & Write
    - Speechify
    - ReadBit
    - Voice Aloud Reader
    - Text-to-Speech
    - ClaroSpeak
    - Apple Accessibility Suite
- **Microsoft Windows:**
    - Texthelp: Read & Write
    - CBoard
    - Speechify
    - Microsoft OS Narration
    - Natural Readers
    - Snap & Read

    - Verbose
    - Read Aloud: A Text-to-Speech Voice Reader
    - Text from Speech
    - Immersive Reader
    - Helper Bird

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Select websites from a pre-selected list of websites related to finding help in an emergency
- Navigate to selected websites and use relevant tools with the selected websites to read the text on the pages
- Prompt participant to think aloud through the process of selecting sites, selecting T2S tools, using T2S tools, and reading the information on the webpages

4.4.1.4 Original Scenario 1d: Use S2T Tools (on Forms) to Find Help

Potential Challenge(s) Addressed:

- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Android Accessibility Suite

    - SpeechTexter
    - Voice to Text
    - Voice typing via keyboard
- **iPad:**
    - Apple voice controls
    - Voice typing via keyboard
- **Microsoft Windows:**
    - SpeechTexter
    - Text from to Speech
    - MS Speech Recognition

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected website(s) containing forms
- Use relevant S2T tools to produce text and fill in forms
- Prompt participant to think aloud through the process of selecting tools to help with producing text, using the selected tools, and producing text

4.4.1.5 Original Scenario 1e: Use S2T Tools (in Messages) to Find Help

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)

- Browser (Microsoft Edge, Google Chrome)
- Communication App (WhatsApp, Messenger, etc…)
- **Android:**
    - Google Assistant
    - Amazon Alexa
    - Android Accessibility Suite
    - Voice typing via keyboard
- **iPad:**
    - Amazon Alexa
    - Siri
    - Apple voice controls
    - Voice typing via keyboard
- **Microsoft Windows:**
    - Text from to Speech
    - MS Speech Recognition

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Use relevant S2T tools to produce text to be sent as a message
- Prompt participant to think aloud through the process of selecting tools to help with producing text, using the selected tools, and producing text

4.4.1.6 Original Scenario 1f: Use Apps to Find Help

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information

- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - What3words
    - Google Maps
    - UK Bus Checker
    - Get help in an emergency using your Android phone
    - Uber
- **iPad:**
    - What3words
    - Google Maps
    - UK Bus Checker
    - ICE (In Case of Emergency)
    - Uber
- **Microsoft Windows:**
    - What3words
    - Google Maps
    - Uber

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Prompt participants to imagine being in an emergency situation
- Navigate to and use relevant tools to find help in an emergency
- Prompt participants to think aloud through the process of deciding which apps/tools/sites to use, using the selected apps/tools/sites, and deciding if they learned what they needed to learn

4.4.1.7 Original Scenario 1g: Connect with Others to Find Help and Support

Potential Challenge(s) Addressed:

- Signing in or completing authentication processes

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Facebook
    - Instagram
    - WhatsApp
    - Zoom
    - Google Meet
    - Messenger
    - Tactiq for Google Meet and Zoom Trascription
    - BirdHouse
    - SnapChat
- **iPad:**
    - Facebook
    - Instagram
    - WhatsApp
    - Zoom
    - Google Meet
    - Messenger
    - Tactiq for Google Meet and Zoom Trascription
    - BirdHouse
    - SnapChat
- **Microsoft Windows:**
    - Facebook
    - Instagram
    - Zoom
    - Google Meet
    - Tactiq for Google Meet and Zoom Trascription

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Prompt participants to imagine being in an emergency situation
- Navigate to and use relevant tools to find help in an emergency
- Prompt participants to think aloud through the process of deciding which apps/tools/sites to use, using the selected apps/tools/sites, and deciding if they learned what they needed to learn

4.4.1.8 Original Scenario 2a: Use Video-Based Tools to Prepare for an Emergency

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - YouTube
    - TikTok
    - Vimeo
- **iPad:**
    - YouTube
    - TikTok
    - Vimeo

- **Microsoft Windows:**
    - YouTube
    - TikTok
    - Vimeo
    - YiNote

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected video about preparing for an emergency using via apps or a web browser
- Repeat as needed for additional videos
- Prompt participant to think aloud during the process of finding and viewing the videos

4.4.1.9 Original Scenario 2c: Use T2S Tools to Prepare for an Emergency

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Dolphin Easy Reader
    - Texthelp: Read & Write
    - Android Accessibility Suite

    - IDEAL Group Reader
    - CBoard
    - Speechify
- **iPad:**
    - Dolphin Easy Reader
    - Texthelp: Read & Write
    - Speechify
    - ReadBit
    - Voice Aloud Reader
    - Text-to-Speech
    - ClaroSpeak
    - Apple Accessibility Suite
- **Microsoft Windows:**
    - Texthelp: Read & Write
    - CBoard
    - Speechify
    - Microsoft OS Narration
    - Natural Readers
    - Snap & Read
    - Verbose
    - Read Aloud: A Text-to-Speech Voice Reader
    - Text from Speech
    - Immersive Reader
    - Helper Bird

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Select websites from a pre-selected list of websites related to preparing for an emergency
- Navigate to selected websites and use relevant tools with the selected websites to read the text on the pages
- Prompt participant to think aloud through the process of selecting sites, selecting T2S tools, using T2S tools, and reading the information on the webpages

4.4.1.10 Original Scenario 2d: Create Personal Memos to Prepare for an Emergency

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Google Assistant
    - Amazon Alexa
    - SpeechTexter
    - Android Accessibility Suite
    - MindManager
    - Quick Note
    - Voice Notebook
    - Google Keep
    - Microsoft OneNote
    - Evernote
    - Simplenote
    - Milanote
    - PowerPoint
    - Buncee
    - Floaty for Sticky Notes
    - LucidChart
- **iPad:**
    - Google Assistant
    - Amazon Alexa
    - MindManager
    - Google Keep
    - Evernote

    - Simplenote
    - Milanote
    - PowerPoint
    - Buncee
    - Siri
    - Apple Dictation
    - Post-it
    - Apple Notes
    - Apple Voice Memos
    - Ulysses
    - Lucidchart
    - Lucidspark Mindmapping Software
- **Microsoft Windows:**
    - Google Assistant
    - Lucidspark Mindmapping Software
    - MindManager
    - Microsoft Sticky Notes
    - Floaty for Sticky Notes
    - Microsoft To-Do List, Task and Reminder
    - Microsoft Whiteboard
    - Google Keep
    - LucidChart
    - Smart Draw
    - PowerPoint
    - Buncee

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to and use relevant tools to make voice notes about preparing for an emergency
- Prompt participants to think aloud through the process of deciding which apps/tools/sites to use and using the selected apps/tools/sites

4.4.1.11 Original Scenario 2e: Use Note-Taking and Mind-Mapping Tools to Prepare for an Emergency

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Google Assistant
    - Amazon Alexa
    - SpeechTexter
    - Android Accessibility Suite
    - MindManager
    - Quick Note
    - Voice Notebook
    - Google Keep
    - Microsoft OneNote
    - Evernote
    - Simplenote
    - Milanote
    - PowerPoint
    - Buncee
    - Floaty for Sticky Notes
    - LucidChart
- **iPad:**
    - Google Assistant
    - Amazon Alexa
    - MindManager
    - Google Keep
    - Evernote
    - Simplenote
    - Milanote

    - PowerPoint
    - Buncee
    - Siri
    - Apple Dictation
    - Post-it
    - Apple Notes
    - Apple Voice Memos
    - Ulysses
    - Lucidchart
    - Lucidspark Mindmapping Software
- **Microsoft Windows:**
    - Google Assistant
    - Lucidspark Mindmapping Software
    - MindManager
    - Microsoft Sticky Notes
    - Floaty for Sticky Notes
    - Microsoft To-Do List, Task and Reminder
    - Microsoft Whiteboard
    - Google Keep
    - LucidChart
    - Smart Draw
    - PowerPoint
    - Buncee

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to and use relevant tools to make notes and mind maps about preparing for an emergency
- Prompt participants to think aloud through the process of deciding which apps/tools/sites to use and using the selected apps/tools/sites

4.4.1.12 Original Scenario 3a: Use Video-Based Tools to Learn What to Do in an Emergency

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - YouTube
    - TikTok
    - Vimeo
- **iPad:**
    - YouTube
    - TikTok
    - Vimeo
- **Microsoft Windows:**
    - YouTube
    - TikTok
    - Vimeo
    - YiNote

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected video about what to do during an emergency using via apps or a web browser
- Repeat as needed for additional videos
- Prompt participant to think aloud during the process of finding and viewing the videos

4.4.1.13 Original Scenario 3b: Use Image-Based Tools to Learn What to Do in an Emergency

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Instagram
- **iPad:**
    - Instagram
- **Microsoft Windows:**
    - Instagram

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to pre-selected Instagram posts about what to do during an emergency using via apps or a web browser
- Repeat as needed for additional Instagram posts
- Prompt participant to think aloud during the process of finding and viewing the Instagram posts

4.4.1.14 Original Scenario 3c: Use T2S Tools to Learn What to Do

Potential Challenge(s) Addressed:

- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Dolphin Easy Reader
    - Texthelp: Read & Write
    - Android Accessibility Suite
    - IDEAL Group Reader
    - CBoard
    - Speechify
- **iPad:**
    - Dolphin Easy Reader
    - Texthelp: Read & Write
    - Speechify
    - ReadBit
    - Voice Aloud Reader
    - Text-to-Speech
    - ClaroSpeak
    - Apple Accessibility Suite
- **Microsoft Windows:**
    - Texthelp: Read & Write
    - CBoard
    - Speechify
    - Microsoft OS Narration
    - Natural Readers
    - Snap & Read
    - Verbose
    - Read Aloud: A Text-to-Speech Voice Reader

    - Text from Speech
    - Immersive Reader
    - Helper Bird

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Select websites from a pre-selected list of websites related to what do do in an emergency
- Navigate to selected websites and use relevant tools with the selected websites to read the text on the pages
- Prompt participant to think aloud through the process of selecting sites, selecting T2S tools, using T2S tools, and reading the information on the webpages

4.4.1.15 Original Scenario 4: Learn How to do User-Friendly Device Set-Up

Potential Challenge(s) Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)

- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - Assistive Touch
    - Minimal Consent
    - Free AD Blocker
    - Blockada 5
    - Android Accessibility Suite
- **iPad:**
    - Assistive Touch
    - BlockBear!
    - Blokada 5
    - Minimal Consent
    - Voice Over
    - Apple Voice Control
    - Apple Assistive Touch
    - Apple Touch Accommodations
    - Apple Back Tap
    - Apple Siri
    - Apple Accessibility Keyboard
    - Apple Dictation
    - Apple Predictive Text
- **Microsoft Windows:**
    - Minimal Consent
    - Blokada 5
    - Mercury Reader
    - Microsoft Windows 10 Accessibility: Vision
    - Dualless for Google Chrome
    - Cookie Notice Blocker
    - Total AD Block

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to relevant menus and/or apps on personal device to install and/or activate relevant accessibility features

- Prompt participant to think aloud through the process of finding, installing and/or activating, and using relevant tools
- Prompt participants to explain why they do or do not want to install and/or activate particular tools and/or features

4.4.2 Revised Scenarios

4.4.2.1 Revised Scenario 1: Participant Directed Scenarios

Potential Challenge(s) Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Stopping animations and auto-play videos or audios
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- Relevant Apps (will change based on participant)

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Prompt participant to imagine being in an emergency situation

- Prompt participant to think aloud through the process of thinking about being in an emergency situation
- Prompt participants to demonstrate their use of tools that they mention while responding

4.4.3 New Scenarios

4.4.3.1 New Scenario 1a: Managing Healthcare via Apps

Potential Challenge(s) Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - My GP
    - Push Doctor - Online Doctor Appointments & Advice
    - Video GP
    - Hey Pharmacist
- **iPad:**
    - My GP
    - Push Doctor - Online Doctor Appointments & Advice
    - Video GP
    - Hey Pharmacist
- **Microsoft Windows:**
    - Hey Pharmacist

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to relevant websites and apps for the management of healthcare
- Prompt participant to think aloud through the process of using selected website(s) and/or app(s)

4.4.3.2 New Scenario 1b: Managing Mental Health and Well-Being

Potential Challenge(s) Addressed:

- Signing in or completing authentication processes
- Entering data or filling out forms, avoiding and correcting errors
- Accomplishing multi-stage tasks
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focused on the task at hand, limiting interruptions, reminders, and changes in content
- Using complex interfaces and intricate navigation patterns
- Processing information on cluttered pages, avoiding cognitive overload
- Getting focussed on the task at hand, limiting interruptions, reminders, and changes in content
- Understanding text and graphics
- Finding information
- Following instructions
- Looking for help or support

Tool(s) Used:

- Device (laptop, tablet, or mobile phone)
- Browser (Microsoft Edge, Google Chrome)
- **Android:**
    - My GP
    - Push Doctor - Online Doctor Appointments & Advice
    - Video GP
    - Hey Pharmacist

- **iPad:**
    - My GP
    - Push Doctor - Online Doctor Appointments & Advice
    - Video GP
    - Hey Pharmacist
- **Microsoft Windows:**
    - Hey Pharmacist

Equipment Needed for Task/Activity:

- Device (laptop, tablet, or mobile phone)

Equipment Needed for Recording Experiment/Data Capture:

- Audio- and/or video-recording equipment
- Screen capture tools
- Observation protocol
- User Survey

Procedural Instructions:

- Navigate to relevant websites and apps for the management of mental health and well-being
- Prompt participant to think aloud through the process of using selected website(s) and/or app(s)

5 END-USERS' CHALLENGES DURING USE OF ASSISTIVE TOOLS

5.1 SUMMARY

During co-labs, people experimented with tools to tackle their daily digital challenges, but even so could not interact successfully with the digital world. This section aims to present relevant data and analysis regarding instances and participants that were unable to use accessibility tools directly and did not engage successfully with scenarios' work in the way that was originally planned.

It was frequently impossible to carry out formal co-lab tools work without a period of acquaintance and trust building. introducing the LIVE IT project and its aims and gauging the reality of both cognitive challenges and difficulties as well as participants familiarity and capabilities with both devices and websites. In some cases, we had to move away from the idea of scenarios and formal accessibility tools work when this proved excessively challenging for participants. In these cases, we worked with participants to find out the ways in which participants use websites and devices in their everyday lives, if at all. Whether they could read and what other key challenges they experience with both on-line content and with technology in their lives. Many participants found a formal assessment of accessibility tools too complex and demanding due to a combination of factors including short attention spans, anxiety associated with technology usage and text-based websites, difficulties using new accessibility applications, reading problems and very low technological skills, coupled with the abstraction of working with emergency scenarios.

Many of the participants we were working with had complex and significant challenges, sometimes with additional life challenges related to low income and poor support opportunities – especially in UK co-labs. Many had experienced layers of exclusion in their lives, coupled with concurrent and related mental health, and other serious existential challenges such as isolation and housing need to name but a few.

We were in theory working with four theme scenarios. This was most challenging in the UK co-labs, where the theme was 'emergency' and which was possible to do this with a few 'technologically skilled' individuals. Many others had to be coaxed and the idea of emergencies or urgent need explored in the context of web-accessibility and technology. For many 'emergency scenarios' was too abstract and unhelpful in terms of exploring whether and how they used the 'web' and 'websites' at all.

For participants, the abstract nature of digital terms and interactions required the imagination of scenarios, such as, 'what if this or that occurred or somebody in your family/group was ill, had an

accident, there was a fire etc.'. We had to gauge this carefully and consult with carers in order to work out what could be explored in individual cases. Many of our participants avoided standard websites and technology for a range of reasons, preferring human interaction and support, audio-visual technology (largely on smart-phones) and website usage such as; YouTube, Tik-Tok, TV, Instagram and similar, facetime and video calling applications, for news and information. We saw a wide range of differing and complex combinations of cognitive challenges, coupled with other personal challenges that frequently relate to mental health and feelings of exclusion or worthiness in participants. Particularly when trying to direct non-readers towards text-based websites, information and digital tools or accessibility applications and tools. Significant anxiety arose with a number of participants in relation to the LIVE IT co-lab work. Additionally, a large percentage of those involved in the South London lab were non-readers, or had significant reading challenges, coupled with very low or non-existent device and IT skills.

Most of participating users did use phones, tablets and the web, frequently in very specific and limited ways that they were familiar with (YouTube or on-line jigsaws for example in one case). Some did not have access at all (internet or suitable technology) except in open access community centres or similar with facilities for IT access. An across consortium observation also was that users depend on a high level to relatives or carers to successfully interact with the digital world.

The message that came across was that every case was complex and individual. Skills support, device optimisation and training are a need. For many the existing 'web' is not 'designed for us' and does not take the complex range of neurodiverse challenges and needs into account. Fully customisable and simple sites or site versions are necessary, with suitable signposting, alternative text and images and more curated audio-visual alternatives for many, especially those with reading challenges. There were a surprisingly high number of participants that had significant reading challenges or could not read effectively at all – this problem becomes of utmost importance considering that non-English speaking people face 'dual exclusion' and cannot benefit from most assisting tools that use English language. Some participants had technology such as laptops, tablets or smart phones that they could not use.

The communities and people that LIVE IT worked with were characterised by significant needs and challenges, with generally poor or medium personal resources and skills. During the course of the LIVE IT co-lab work, it was quite shocking to discover how many of our cohort could not read without help or were unable to carry out the most basic functions on web access devices such as smart-phones, tablets, PCs and laptops. It should also be noted that this was all taking place in community spaces, schools and consortium premises with participants taking part on a voluntary basis, often in venues that they wanted to use for primarily social face to face activities, personal support and fun. Despite the earlier assertion that there was strong interest, which was true in the

sense that participants wanted better accessibility and ‘a web that is designed for us’, this was never something that LIVE IT could provide in the project’s lifetime. Participants were keen to be involved in improving web accessibility through consultation and experimentation.

Participation in LIVE IT co-lab sessions was challenging and difficult for most of our participants with significant issues, and impossible directly for some. Anxiety causing also for some of our participants where attention and span, dealing with text and symbols, reading, typing or navigating on-line, screen appearance and other difficulties, including keyboard or button usage, were significant.

Other key issues of note should also be pointed out before presenting a breakdown of the challenges and reasons for difficulty that were experienced with participants and the ‘testing’ of accessibility apps model that the LIVE IT Project’s co-lab model was using.
The scenarios intended for the co-labs proved somewhat unhelpful in some cases. Participants had very limited interest in the internet and on-line information relating to emergencies in the case of those with the most significant challenges. Those with significant reading challenges or aversion to text-based sites stated that they would seek real life help or reach for a phone to call a trusted support person. Although there were also many participants that engaged, mainly those with a reasonable level of IT and reading skills.

Interestingly, one Downs Syndrome participant, who was making progress with learning to read, learnt also from TV shows (and Fairy Tales), he had watched on-line using YouTube or on TV. He was able to talk about strategies such as “get down, get down” referring to what you have to do in a fire if there is smoke build up. This was something he had picked up from a police drama series. A decision was made with his carer to not engage with text to speech applications, as it could potentially interfere with the progress he was making with reading and writing. He was unable to engage with the app trial approach at all but was enthusiastic and informative showing us what he could do on a laptop. He was introduced to the idea of voice search in YouTube, and predictive text in searches.

Those with some IT skills who found text problematic (ASD and Dyslexic participants on the whole, with additional issues such as ADHD, Brain Injury and a myriad of Cognitive Disabilities simply labelled using an umbrella term as ‘Learning Disabilities’) were drawn to and preferred audio-visual and social media sites such as YouTube, Instagram and TikTok for information. In most cases participants exhibited variable awareness of the difficulties that these sites present in terms of reliable and trusted information sources.

This observation was made across all co-labs – participants preferred audio-visual information and scenarios including such interactions were easier to implement than tasks involving only or mainly text interactions.

5.2 AVERSION, ANXIETY AND READING DIFFICULTY

Many of our participants found engagement with the technology in use, accessibility apps and the co-lab model of questions and site navigation, challenging or impossible, or anxiety causing, frequently both. Many lost focus very quickly, were unable to do things like find, download and install apps for themselves, so had very limited interest in or understanding of what we were doing in terms of trialling and evaluating accessibility tools. Based upon that, a revised version of scenarios was applied in such instances, to draw attention, raise engagement levels and steer the scenario towards the participants' likes and preferences.
There was strong interest from many participants in the idea of improved web access and an internet they could use. In the vast majority of cases in order to maintain some engagement, researchers had to introduce the concepts and then find out what participants could or did do online, and with what tech and apps. In many cases individuals were reluctant or refused to re-engage after an initial introductory session with comments like "the questions they are so long", "it's so hard", "I wouldn't do that", or of course "I can't read", a qualification that most participants hid from the world or were extremely reluctant to admit to or verbalise, except to a trusted few. Although, participants experimenting with text-to-speech tools and speech-to-text tools managed to successfully implement the initial scenarios (Ireland and Portugal co-labs examples), while revised versions were required only for scenarios involving composing and writing (Irish co-lab example).

Rather than attempt to coerce participation according to our co-lab accessibility applications testing model, researchers guided challenged individuals through some limited web access and accessibility options, and recorded participants thoughts on skills, wants, needs, interests and challenges in terms of device usage and web-accessibility. In many cases this amounted to providing very basic IT skills and device optimisation help. There was most interest in built in free accessibility applications in Android and Apple IOS phones and tablets, as well as Windows, Google and Apple IOS built in accessibility features for devices including laptop PCs. Often screen reading and voice control applications were of significant interest.

The researchers engaged with individuals and support organisations, many participants were already known to the researchers and/or participating organisations. Post COVID-19 lockdown periods (and during, when support organisations were permitted to meet) there was a hunger for

face-to-face social interaction, as all of our participants had been horribly isolated and also experienced significant social exclusion as a matter of course due to their 'differences' from neurotypical people. These difficulties were amplified by a lack of access, skills and on-line services that worked for them, in a period where the whole world went on-line only, excepting those excluded from internet and on-line access due to the challenges and reasons listed above.

As a result, there was strong initial interest, followed by withdrawal in some cases, when prospective participants realised how challenging LIVE IT co-lab work was for them. What they really wanted and needed was social interaction and inclusion, rather than more technological interaction. It is also important to note that in some cases participants were publicly sensitive about their 'disability/ies', showed reticence about allowing others to know they had difficulties at all, or the extent of those difficulties. A number of our participants also reported on how poorly they had been supported in school (except to special schools) and by social and other institutional services.

A particularly illuminating case involved two female participants in their mid-teens and early twenties with ASD who were really expressive in terms of what they did on-line and why over the course of several co-lab sessions. These participants were sisters, with a good support network, both were very able and had IT-skills, but had significant aversion to text and text-based sites due to their ASD. The usual text-based websites were invariably anxiety causing and required significant accessibility help in order to be useful (mind-maps, filters and overlays, breaking text down into blocks and simplifying, noting key point summaries for dense information in text form). Both invariably preferred and used image, audio and video based social media sites preferably, that used simple captions. These included, TikTok and Instagram in particular. The elder of the two (15yrs and 21yrs), a single parent with an under 5-year-old son, engaged over a period of several months and in several short sessions quietly elucidating the challenges and solutions she had implemented, and why the LIVE IT model was not of significant interest to her.

An illustrative excerpt from field-notes that may be illuminating:

"A realisation following another session with L... who is on the autistic spectrum yesterday, bright as a button. She's been saying from the start that she avoids text-based sites, lists, questionnaires and many layouts. Too much text does all sorts of weird things to her head and vision, the implied stresses at college led to a breakdown of sorts. She was really eloquent again (We've had several informal sessions with her and her sister) and making a point.

What she and others have been saying is that what works best for her is image, video and audio. And here we are still trying to get her to try things she's no desire or interest in using. She was

coming up with all of the really valid reasons why not to, or why she doesn't use a particular tool or type of website (in terms of her cognition differences and needs). It's incredibly individual, but a large number of our ASD South London participants similarly avoid text-based sites in this way.

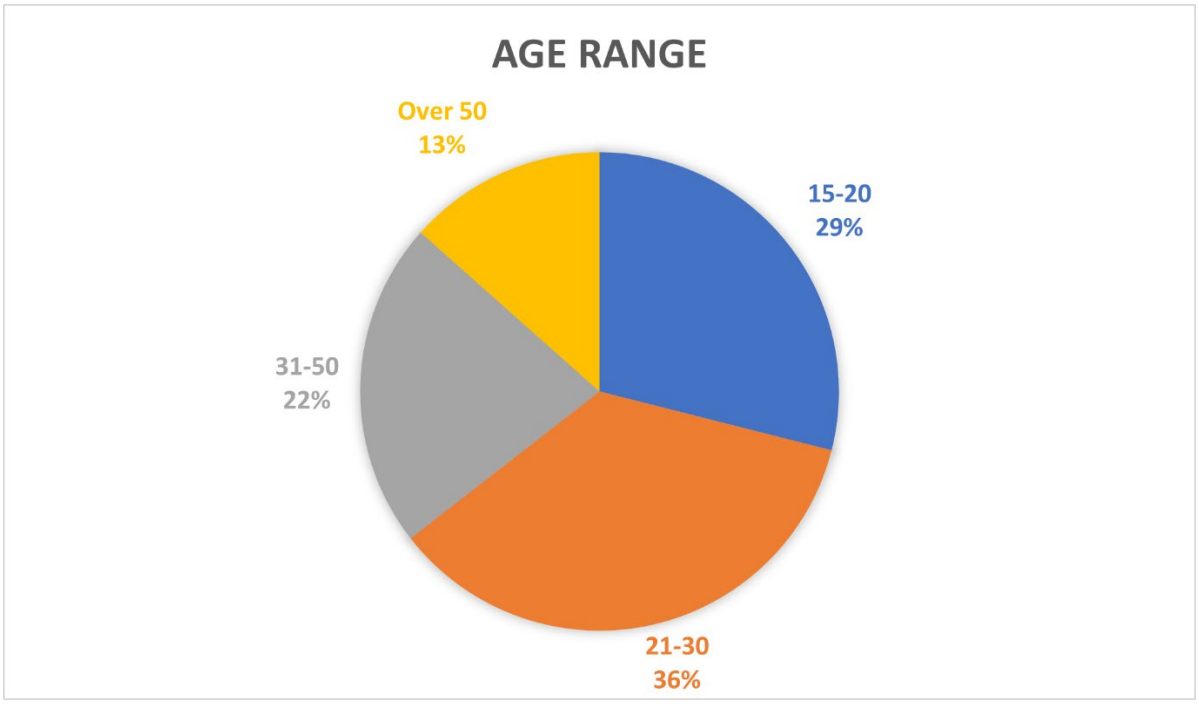
What sessions with L and others seem to suggest is that if anyone is really serious about digital inclusion and people like L..., then rather than try and turn her into something she can't or struggles to be, we should listen to what she's saying and provide simplified accessible and signposted alternatives. i.e., video and audio versions or links to animated and video information casts etc.

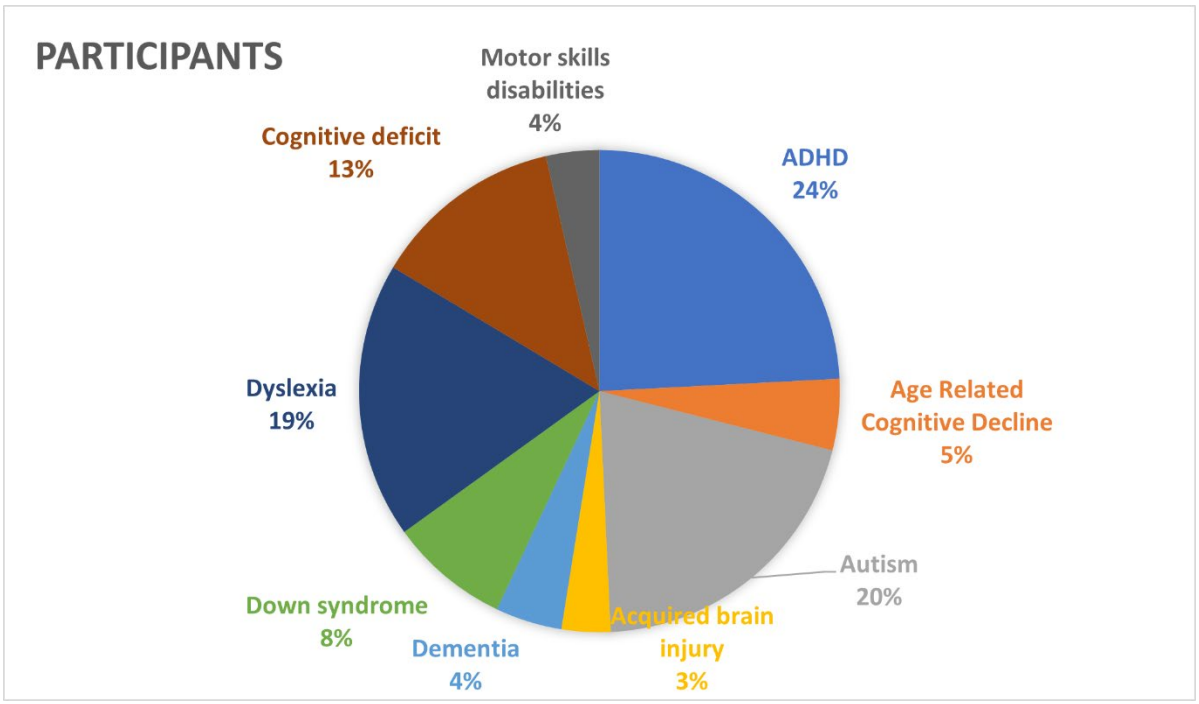
Of course, she knew that all along, and that's why she's kept telling us what you can do with Tok-Tok, Snapchat, Instagram, and YouTube. Whilst also raising concern about 'fake news', disinformation and online bullying, mental health concerns and ChildLine as examples of things that matter to her.

She'll preferentially reach for a phone, facetime or a person she trusts as soon as she can, because she's learnt that that works, whilst others are trying to make her fit their boxes and do her things their way! And I realised that that was what we were doing with her too, and she was genuinely taking us at face value and trying to educate us it seems on reflection on what needs to change."

5.3 ANALYSIS

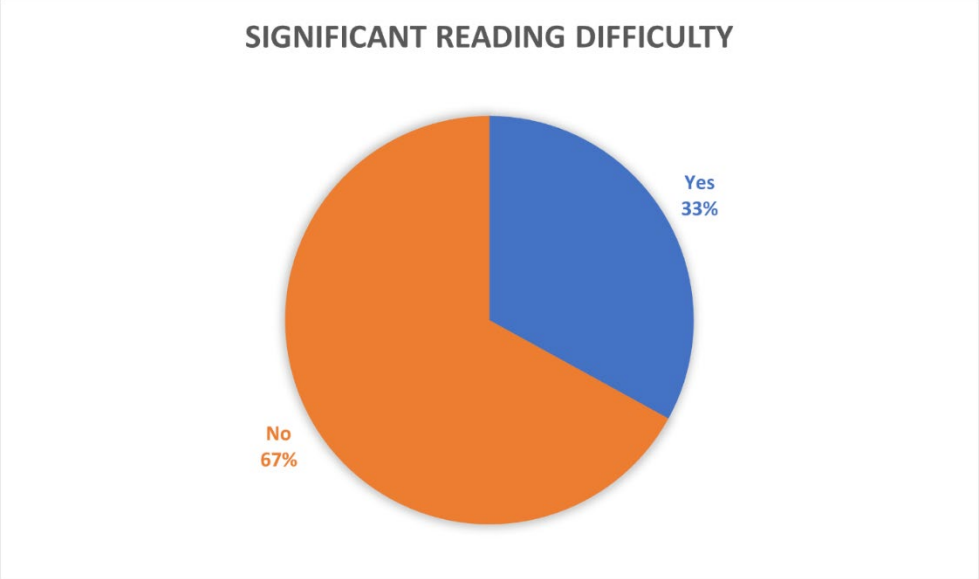
Using the most comprehensive data we have on twenty-one of the London co-lab participants a partial picture may be presented. Below are graphs of all the variables that were recorded, cross tabulating the ability to use tools against the other variables.


AGE RANGE
Over 50
13%
15-20
29%
31-50
22%
21-30
36%


PARTICIPANTS
Motor skills disabilities
4%
Cognitive deficit
13%
ADHD
24%
Dyslexia
19%
Age Related Cognitive Decline
5%
Autism
20%
Down syndrome
8%
Dementia
4%
Acquired brain injury
3%

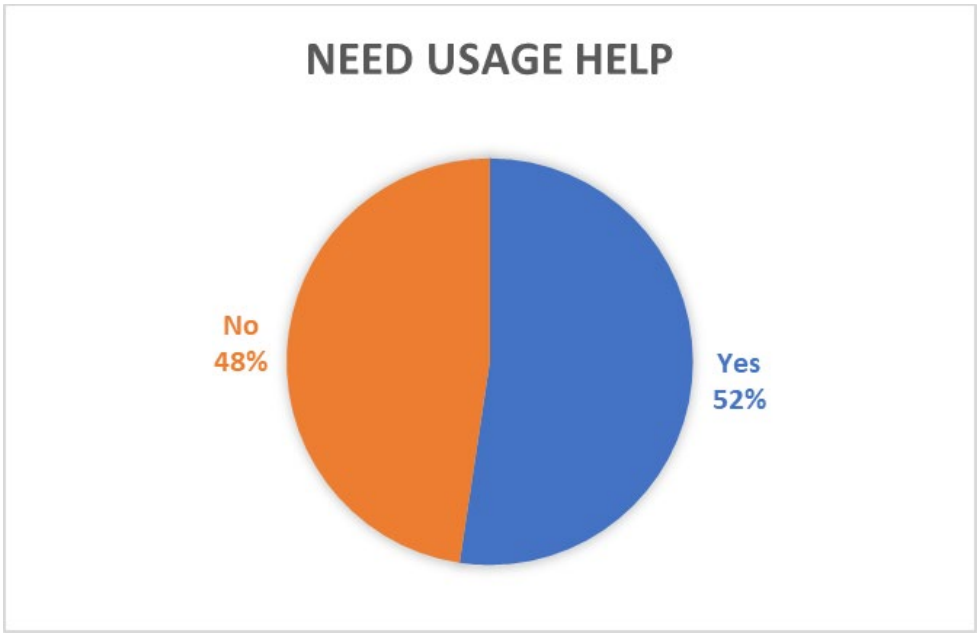
5.4 READING ABILITY

Perhaps the biggest challenge experienced was the reading ability of participants. Two thirds of co-labs participants were able to read well enough to deal with tools usage and text-based websites effectively without significant help, when in nature language, although the interaction with global websites and digital world, or provided accessibility tools was compromised by the lack of versions for non-English speaking users – an issue that could be regarded as indirect reading inability.

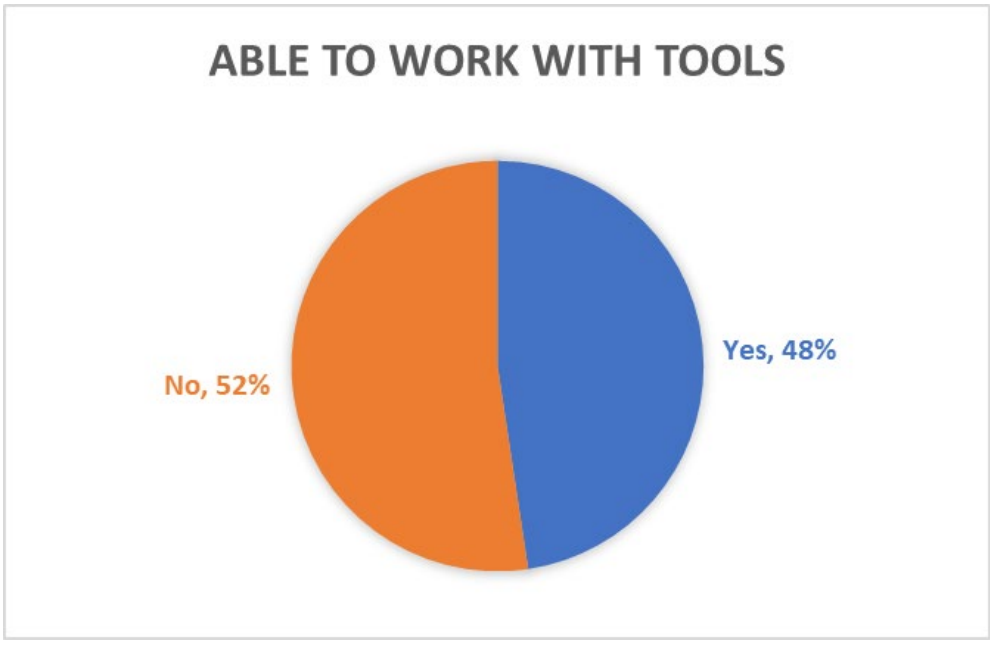


5.5 DEVICES, SKILLS AND TOOLS USAGE HELP

Nearly half of our participants needed significant help with device usage and tools had to be demonstrated for them rather than used independently. Effectively co-lab sessions with these participants became device optimisation and a demonstration of possibilities, with limited participant tools usage:

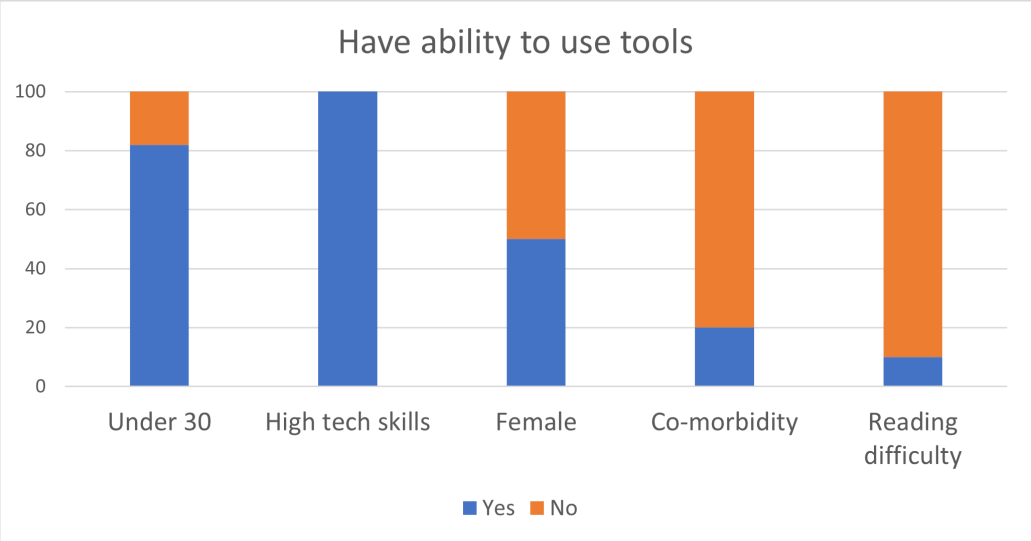


Slightly less than half of our participants were able to work with tools in our co-lab scenarios exploration as indicated below:



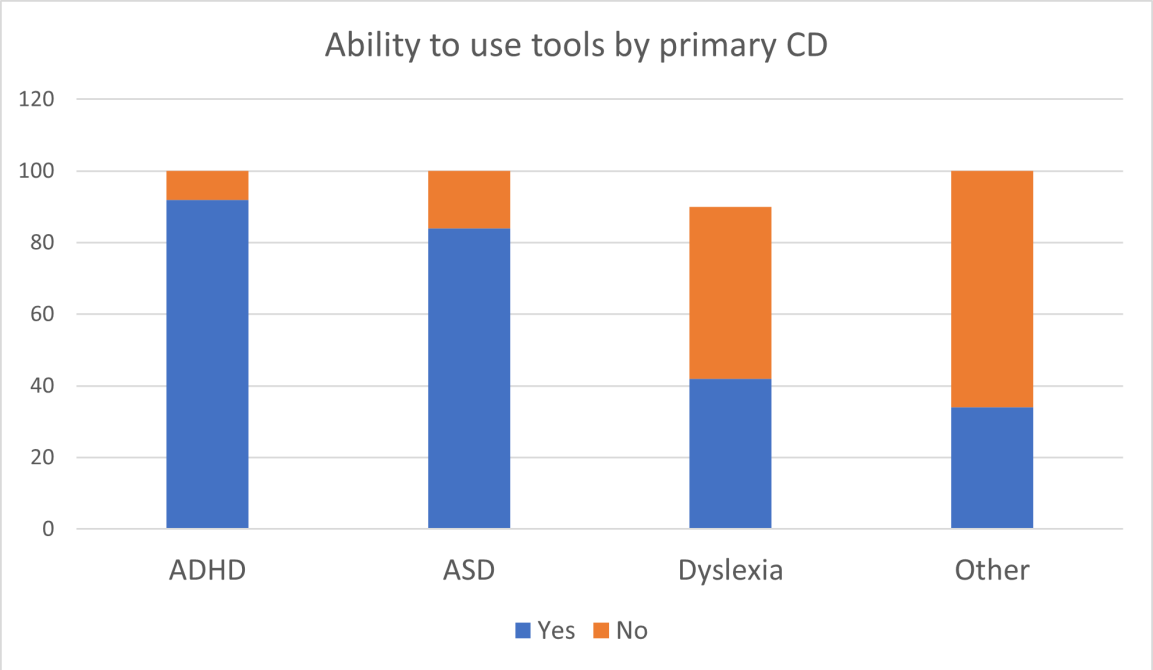
5.6 CORRELATING CHALLENGE FACTORS

Correlating the various factors at play, we find the following in terms of ability to work with tools directly in some fashion in our co-lab scenarios or web usage explorations:



As shown in the graph, participants who were able to use the tools effectively were:

- Younger (80% below the age of 30)
- More technically highly skilled (100% level 4 and 5)
- Both female and male participants
- Less likely to present with a cognitive co-morbidity (20% with co-morbidity)
- Less likely to present with reading difficulty (10%).



As the above graph shows, an association was found between primary cognitive disability presented and ability to use tools effectively. Participants with dyslexia were less likely to use tools effectively. Participants with ADHD and ASD were more likely to use tools effectively at least for some time.

5.7 CONCLUSIONS

There was a combination of factors in play that prevented meaningful engagement with the accessibility tools trial approach in the LIVE IT co-labs for a significant percentage (52%) of participants. These involved a combination of challenges including most importantly:

1. Significant reading and other skills challenges
2. Significantly low levels of technological skills, coupled with access difficulties and economic hardship
3. Very short attention spans or other behavioural challenges that made understanding and extended session work problematic
4. Aversion and an experience of failure with reading and text-based websites in the past.

It appears that reading ability was a significant factor, but that ability to use tools is shaped by all factors. What was clear in delivery was that device optimisation and technological support is a significant need, in addition to more inclusive web-design, and individually customisable accessibility tools considering that the information contents should be successfully transmitted to

the end-user to fully activate and engage in a digital accessible daily experience. This information includes navigating digital contents, finding what is needed, understanding the process required to act upon, act freely and independently upon it, using tools and services, reaching out, sharing experiences and connecting with the parallel digital world.

6 THE GENDER DIMENSIONS

This section focuses on the 'gender dimension' in LIVE IT. It sets out how the project approached the issue of gender in its objectives and activities; what actions were taken to explore how gender shapes the digital life of people with cognitive disabilities; whether gender is associated with the use of particular tools to support web accessibility and whether there are differences in outcomes associated with the use of these tools according to gender. It presents the key conclusions of the work on gender and their implications going forward.

6.1 POSITIONING THE GENDER DIMENSION IN LIVE IT

LIVE IT made a commitment in its project implementation plan to explore the gender dimension in two main ways:

- To deepen understandings of the role sex and gender plays in the relationship between cognitive impairment and digital inclusion (through the state-of-the-art review and lifeworld analysis)
- To embed a gender dimension in the development of tools to support inclusive web accessibility in the Labs and in the production of the Open Toolkit and meta-environment.

The first objective was addressed as follows:

- Establishing an overview of the broad picture of gender, cognitive disability and web accessibility through a limited 'realist review' of the literature, looking for key themes
- Drilling down further into the literature to map the landscape of inclusive web accessibility, focusing on the perspective of people with cognitive disabilities. This was done through a systematic review of the literature in three academic databases: SCOPUS, ProQuest, and Web of Science, using rapid evidence assessment methods.
- Supplementing the literature review with an 'interventions review'. This interventions audit collected, collated and analysed examples of good practices – 'interventions'- including examples of platforms and tools - that have the potential to support inclusive web accessibility. It was carried out using 'scientific realist review'.
- Documenting and understanding how the digital world operates within the lived experience and daily lives of people with cognitive disabilities by carrying out 'lifeworld analysis' research combining 7 Focus Groups involving 60 people and 52 face to face

interviews with people with cognitive disabilities and their carers. The focus groups and interviews were supplemented by observation analysis involving 38 people with cognitive disabilities and content analysis of 68 key documents.

The second objective was addressed by:

- Promoting equal gender representation in project activities, including the 'lifeworld analysis, Co-Lab activities and the Hackathons
- Documenting and assessing the extent to which variations in the use of tools within the Co-Labs and Hackathons – and the outcomes associated with the use of tools – can be linked to gender.

The following sections report on the above work:

- First, we provide a brief overview of the main themes highlighted in the general literature review
- This is followed by the key findings of the focused systematic review, the interventions audit and the lifeworld analysis
- The next section of the document assesses gender representation in the LIVE IT project
- The following section explores gender variations in the use of tools to support web accessibility
- The concluding section presents the main conclusions on the gender dimension together with their implications going forward.

6.2 OVERVIEW: GENDER, COGNITIVE DISABILITY AND DIGITAL LIFE

The gender dimension of cognitive disability and web accessibility is complex. One common strand in the literature is an acknowledgement that there does appear to be a link between gender and patterns of disability, their underlying causes and their associated impacts. However, this link is both contested and lacks an established evidence base. On the one hand, it is fairly well-accepted that the incidence of cognitive disability across a range of presenting disorders is associated with gender. For example, a consistent pattern in the epidemiology of Autism Spectrum Disorder (ASD) is the higher prevalence in males compared to females, with ASD diagnosed four times more often in males than in females, although this rate has been found to vary across different studies (Maenner et. al., 2020; Napolitano et. al., 2021).

More contested and less well-established is the evidence that tries to establish the causal pathways between gender and cognitive disability. For example, gender is associated with increased risk of developing dementia in several European cohort studies, which seems to be linked to lifestyle factors such as occupation, exercise and diet (Gilsanz et. al., 2017). Similarly, the evidence suggests that, although boys are more likely to present with ADHD than girls, females presenting with ADHD are more likely to present with co-morbidity issues, and to continue presenting these into adulthood- for example through depression, anxiety, unhealthy lifestyles

(Hasson and Fine, 2012). What seems to be a recurrent theme in these studies is that combinations of biological, social and cultural factors serve to shape the relationship between gender and cognitive disability, and subsequently its effects (Au et. al, 2107). For example, a study in China showed that mild cognitive disability in men was associated with a history of smoking and hypertension, and for women with a history of illiteracy and farm labour occupations (Liu et. al. 2022). Similarly, a study in Japan, looking particularly at the 'health-survival paradox' – why women live longer but tend to suffer more debilitations and illness – found that gender differences in cognitive functioning and decline underpin different individual attributes of cognitive disability and their social determinants. In particular, men seem to be more engaged in activities which accumulate intellectual experiences through education and occupation, and this subsequently shapes patterns of cognitive disability and its impacts (Okamoto et. al., 2021).

These combinations of biological, social and cultural factors are not well-understood, and they raise important questions that go beyond mapping the incidence of cognitive disability against socio-demographic and socio-cultural constructs. For example, some research suggests that the social construction of cognitive disability is an important factor in reinforcing gender differences, like in the way teachers treat girls presenting with ADHD differently from how they treat boys (Diamantopoulou et. al., 2007). Moreover, as Thompson, Caruso and Ellerbeck (2003) point out, not only do the research data suggest there may be significant differences in the presentation of some developmental disabilities (both strengths and weaknesses) between females and males in cognitive, behavioral, mental health and pathophysiological domains, but cultural differences in the way males and females with developmental disabilities are treated may have an impact on diagnosis as well as interventions provided. This raises important questions regarding the adequacy of services for females with cognitive disabilities.

This brings into play the distinction between 'sex' and 'gender' in the context of cognitive disability and digital life. In line with WHO and most national guidelines, we define sex as 'the biological aspects of an individual', and something assigned at birth, and 'gender' as 'a social construction relating to behaviours and attributes based on labels of masculinity and femininity', which speaks to the concept of 'gender identity' and the internal perception of their gender someone identifies with (UK Office for National Statistics **Link**). As Barnes (2022) observes "Identity-based views of gender categorization put a cognitive requirement on gender membership... identifying as gender x, is a matter of complex social reasoning and self-understanding. But many cognitively disabled people have little or no access to language. Many tend not to understand social norms, much less to identify those norms as specifically gendered". She points to 'a substantial body of research (which) suggests that there are striking gender differences in the treatment of cognitively disabled people' including the increased risk of sexual abuse, inappropriate medical treatment and endemic disempowerment (McCarthy, 1998). These issues are amplified if we move beyond the narrow binary construction of gender. One study in the US found that adults who identify as transgender or gender non-binary more often reported worsening memory and thinking, functional limitations and depression than cisgender adults. This, it is suggested, may be due in part to anti-transgender

stigma and prejudice that expose transgender people to high rates of mistreatment and discrimination where they live, work, learn, seek health care and age (Cicero E, et al 2021). A separate study found that transgender and gender non-binary adults had significantly higher reports of cognitive disability compared with cisgender adults (Lambrou et. al., 2019).

In relation to digital inclusion, the evidence is clearer, with women much less likely to have access to a smartphone or the internet; much less likely to hold a post in digital and media industries; score lower on average in digital and media competences and have less confidence in their ability to use digital tools (OECD, 2018). These gender differences are again exacerbated by factors such as level of education, social and cultural background and economic status (Cullen, et. al., 2015; 2020). As with the relationship between gender and cognitive disability, gender is mediated through the digital world in complex ways. We know that gender inequalities reinforce digital inequalities and vice versa – an illustration of what has been called 'dual exclusion' (Helsper and van Duersen, 2015) – and that gender influences access to information – which is fundamental to social and political participation. Decreased social and political participation as a result of gender discrimination in turn reinforces the reproduction of inequalities. In addition, females tend to be less confident and more anxious than males about IT use, reducing their sense of digital self-efficacy and increasing perceptions of IT requiring greater effort (Goswami and Dutta, 2015).

Some commentators have argued that gender divisions on the web are responsible for creating 'regressive and destructive forms of social bonds' which, amplified by the globalization of cyberspace, lead to exaggerated forms of individualism, which further accentuates gender inequalities in cyberspace (Toto and Scarinsci, 2021). As more and more of the services that govern day to day existence have moved online as a result of the COVID-19 pandemic, existing gender inequalities on access, ownership of digital devices, digital and media literacy and the capacity to make meaningful use of access to technology have significantly widened (Mariscal et. al., 2019). For example, a recent study on the use of online healthcare services concluded that there is a risk of digital exclusion among those females who are socio-economically disadvantaged, in poor health, or socially isolated, and that this may predispose people with high needs for health services to exclusion from them (Heponiemi et. al., 2020).

Research on the relationship between cognitive disability, gender and the use of digital and media technologies is very hard to come by. The general literature review strongly suggests that these aspects tend to be approached separately, rather than as interconnected phenomena. So, for example, one strand in the literature on gender and the digital world focuses on the norms and values that shape how user interfaces are designed. This mainly covers how tools and content are heavily gendered – for example the use of stereotypical male/female characters and their appearance and clothing in online games; the use of gender targeted advertising in social media and the use of gendered fields in online forms (See for example **Link**). This is mirrored by literature and research on how disability is approached on the web. A significant amount of the literature focuses on ways of supporting web accessibility, a good example being the principles and Guidelines produced by W3C (**Link**). Although there is an extensive body of literature on the

stereotyping of people with disabilities in the media in general there is very little literature that specifically covers how disabled people are portrayed through digital and online content. As a recent report on research in online gaming carried out by 'Scope' observes, there is little published research that explores the experiences of disabled gamers. The research carried out by Scope revealed that around two thirds of gamers with a disability who took part in the research reported barriers to their gaming – the most significant being the affordability of assistive or adaptive technology. The research also suggested that disabled gamers are more engaged than non-disabled gamers across key platforms and touchpoints (**Link**).

One of the few strands in research literature we identified that tries to join the dots between gender, cognitive disability and digital life suggests that some digital tools may be more effective in supporting people with cognitive disability depending on their gender, and on the presenting cognitive issue. For example, one study on the use of 'Smart Sound' training software to support cognitive rehabilitation in reading disorder found that cognitive rehabilitation increases the working memory capacity of students with special learning disabilities (reading) among girls more than boys (Raziyeh, Turaj and Akbar, 2021). In contrast, another study, which examined whether the use of ICTs improves the writing performance of students with ADHD as well as the impact of gender, revealed that the boys who used ICTs outperformed the boys who did not. However, there was no qualitative difference in the girl's performance, regardless of whether they used or did not use ICTs. The study concluded that attitude and self-belief had a key impact on the use of ICT tools, and the outcomes of that use (Andreou, Riga & Papayiannis, 2016). Since, as noted above, gender is a significant determinant of attitude and self-belief, it follows that it is likely to play an important role in the efficacy and effectiveness of tools to support web accessibility.

A broader strand of work that has tried to get a purchase on the complex inter-relationships between cognitive disability, gender and digital life draws on an intersectional perspective. This aims to expose the interlocking systems that define the lives of excluded and marginalised people (Crenshaw, 1989). It considers people's overlapping identities and experiences in order to understand the complexity of the discrimination and inequalities they face – for example the amplification of domestic violence through gender and disability status (Bhadra, 2019). With regard to digital inclusion, as noted above, it's been known for some time that gender in combination with NEET status (not in education, employment or training) constrains access to and usage of digital technologies, which in turn exacerbates socio-economic disadvantage (Passey et. al., 2008). This is compounded by cultural factors that are embedded in the 'masculine' engineering of technology and in power structures that make it difficult for females to occupy positions of authority in the digital world (Cranmer, 2006; Helsper, 2010; ITU, 2012; Oudshoorn et. al., 2016).

Other research has considered how digital life is experienced through the 'entanglement' of immigration status and low income (Hallbeg et. al., 2016; Powell, 2010). A recent study of the digital life of low-income women in Amsterdam showed that engagement in the digital world was

mainly influenced by motherhood, poverty and the perceived complexities of ICTs – all of which were amplified through being first-generation, non-Western immigrants (Goetard et. al., 2019).

Applying concepts and insights from intersectionality suggests that females and those people with cognitive disabilities who identify as non-binary occupy complex, intersectional spaces in multiple, interlocking communities that reflect highly contextualised access to and potential utilisation of economic, social and cultural capitals – including digital technologies and services. It seems probable that the way these tools and services are currently designed, configured and delivered reflects a gendered disconnect with the lifeworld and lived experience of people with cognitive disabilities. This is further explored below.

6.3 KEY FINDINGS FROM LIVE IT'S PRELIMINARY RESEARCH

6.3.1 Findings from the focused review and interventions audit

The key findings of the focused systematic review we carried out on web accessibility for people with cognitive disability reinforce the conclusions of the general literature review reported on in the previous section. This review entailed a comprehensive content analysis of key policies and guidelines on web accessibility, together with 45 examples of research studies drawn from an initial search of bibliographic databases. The key policies and guidelines analysed include the United Nations (UN) Convention on Rights of Persons with Disabilities (CRPD) - the overarching policy that both informs and drives the EU and individual state policies - as well as the World Wide Web Consortium's (W3C's) Web Content Accessibility Guidelines (WCAG) which serve as a foundation for EU and individual state policies. These over-arching policies and guidelines were criticised for their lack of accessibility specifications to support people with cognitive disabilities, and, in response, WC3 developed the COGA Task Force, whose mission is to improve current accessibility standards and recommend new accessibility standards focused on people with cognitive disabilities.

However, although this development suggests that the cognitive angle is now being taken more seriously in relation to web accessibility in these and other major global policy initiatives, we found little evidence of policies and guidelines linking cognitive disability to gender within the context of web accessibility. For example, the WCAG contains no specific reference to the gender dimension of web accessibility. To take another example, the United Nations Entity for Gender Equality and the Empowerment of Women (UNWomen) has produced a 'Gender Accessibility Audit Toolkit' to support increased web accessibility for females, aimed at policymakers, practitioners and disability rights advocates. The Toolkit reflects the recognition that gender acts as a powerful reinforcer of other barriers that militate against participation: "These barriers create multiple and intersecting forms of discrimination against women and girls with disabilities, in particular, with regard to equal access to education, economic opportunities, social interaction and justice, equal recognition before the law, and the ability to participate in politics and exercise control over their

own lives" (UNWomen, 2018). The Toolkit covers the spectrum of disabilities but has no specific focus on cognitive disability. In addition, although it states that accessibility audits can and should be implemented in sectors like IT services, a lot of the ground covered relates to physical communication barriers and accessibility issues – such as transport systems and building design.

Similarly, our analysis of the research studies carried out in the focused review revealed no studies specifically focused on the role of gender. This finding was reinforced by the audit carried out of over 300 tools and other interventions, for example guidelines, developed to support increased web accessibility for people with cognitive disabilities. We found no examples targeted specifically at females or non-binary groups.

6.3.2 Findings from the lifeworld analysis

As noted above, with regard to digital inclusion, research shows that gender in combination with poverty constrains access to and usage of digital technologies, which in turn exacerbates socio-economic disadvantage. This is compounded by cultural factors that are embedded in the 'masculine' engineering of technology and in power structures that make it difficult for females to occupy positions of authority in the digital world. Other research has considered how digital life is experienced through the 'entanglement' of immigration status and low income. Our LWA research for LIVE IT lends support to this research and its attempt to trace the intersections between gender, disability and socio-economic inequalities. Particularly in the South London, Bristol and Portuguese research sites, we found evidence of cognitive disability intersecting with low income, gender and cultural background to engender 'first order' obstacles to digital engagement – i.e., lack of digital access. For example, one female who participated in the UK lifeworld analysis research reported that her 'whole life has been shaped by her learning disabilities, gender, immigrant status, and poverty'. She is the only female in a 'difficult family' and the family relies on her for economic and other forms of support. She felt that 'the system is against her' – for example in terms of her ability to access an apartment of her own as well as accessing the digital tools and services that would improve her life.

According to the 'multiple access' model (Helsper and van Deursen, 2015), first order barriers lead in turn to the 'second order' digital divide, which focuses on barriers to usage capability - the acquisition of digital competences so people are able to use digital devices efficiently and effectively - and 'quality of use' – whether digital services are designed to meet the needs of vulnerable people. Through our LWA research we found evidence to support this long-established argument that social inequalities – driven in this case through disability and associated intersectionalities like gender and cultural background – influence the acquisition of digital competences. In Portugal, for example, several female LWA participants reported they had little or no digital skills, and welcomed the opportunity to acquire them through the education and training provided in LIVE IT. Equally the LWA highlighted evidence to suggest that digital services are not configured to the needs and situations of people with cognitive disabilities, as illustrated

by the experiences of the mainly female students in Ireland who referred to the dominance of 'ableist' thinking in digital service design and delivery and their feelings of being 'digitally invisible'. It was suggested that girls and women with cognitive disabilities tend to have lower confidence and skills in using digital tools and have usually received less input and support at school. This then lays the foundations for continual disengagement through subsequent life with anything digital. One participant reported that her – now deceased – partner had taken responsibility for everything digital in their home. She could not use a smartphone, PC or tablet without significant help and was now effectively excluded from the web.

A key theme emerging from the LWA, framed through the prism of gender, was that female digital needs are not taken seriously. Several women who participated in the research reported they had to fight to get a diagnosis of cognitive disability formally recognised. Their requests for support were seen as 'shrill or whiney'. This meant they had to cope for many years on their own, leading to additional trauma associated with 'being ignored' added to the trauma of their disability. This seems to be particularly problematic in the case of women perceived as 'high achievers' who – because of their perceived capability – were often categorised as not needing help. As one participant in the LWA carried out in Ireland observed:

> *"And I, I also think in that case, being a woman, and being, having to be persistent because of my condition, which I'm sure there are many who have it, as well. But being a woman, I feel it's a different…If I say a different tone on it, or a different colour, do you know what I meant? Yea. I'm sure there's a nice English or scientific word for it, I just can't remember at the moment because I use phrases like tone and colour".*

One important repercussion of this process in the context of web accessibility is that it lays the foundations for a 'self-defeating behaviour cycle'. One female participant in the LWA research reported she had 'developed an approach that masked her vulnerability and needs'. This reinforced a resistance to asking for help, denial in terms of digital needs and avoidance of online services. Another participant reported a similar pattern. She denies having a disability in public, she can't read and has such difficulty with logging on that jigsaw games and YouTube music videos (if she is helped to log-on) are the only services she can use.

Following the 'second order' divide, the multiple access model introduces a 'third order' dimension, which considers the consequences of digital technologies and their relationship to economic, social, civic and cultural wellbeing. The third-level digital divide focuses mainly on disparities in the returns from internet use within populations of users who exhibit broadly similar usage profiles and enjoy relatively autonomous and unfettered access to ICTs and the internet infrastructure. Third-level divides, therefore, relate to gaps in individuals' capacity to translate their internet access and use into favourable offline outcomes. Although the factors that determine these offline outcomes are complex and sometimes contradictory – for example research by Van Deursen and Helsper suggests that unemployed men use the internet more and extract more benefit from it than employed men, probably because they have more free time –

there appears to be a broad relationship between higher social status and the offline advantages extracted from digital engagement (Van Deursen and Helsper, 2015). Our LWA research suggests that cognitive disability is a strong intersectional factor that interacts with socio-economic status and other factors to shape digital engagement – which means that female people with cognitive disabilities are then more likely to lose out in converting their digital assets into offline assets. For example, one older woman who participated in the LWA found it really difficult admitting need and asking for help. She can't read; has difficulty understanding or answering questions and has difficulty navigating online forms with complex fields. As a result, she was unable to apply for her pension online.

However, the LWA research suggests that different dynamics play out differently in different settings. For example, whilst the research identified the common perception of 'digital invisibility' across the range of research sites covered, and what Habermas has called 'the separation of lifeworld from system' (Habermas, 1984) the research also found evidence of social inclusion being supported when the community opens up spaces for authentic engagement with digital tools in the context of everyday life. One illustration of this is the 'ecological' emergence in the community of digital support networks that provide help and support for people with disabilities. In this context, connectivity challenges, like lack of access to high speed broadband, and usage capability challenges, like limited digital skills training opportunities, can be compensated for by resources and assets sourced from the intersectional communities people with disabilities are engaged with, though, for example, non-disabled females living in the same housing block sharing digital devices with disabled females when needed, and families and peer groups helping each other to acquire digital skills through learning by doing.

6.4 GENDER REPRESENTATION IN THE LIVE IT PROJECT

People with cognitive disabilities were involved in a range of LIVE IT activities as follows:

- preliminary work carried out through baseline research, which entailed carrying out 'lifeworld analysis' research to document and understand how the digital world operates within the lived experience and daily lives of people with cognitive disabilities
- intensive work with participants in the LIVE IT Co-Labs, leading to the mapping and analysis of challenges that prevent people with cognitive disabilities fully benefiting from digital life. These challenges were mapped against 1200 tools with the potential to deliver solutions to these challenges
- subsequent co-creation work carried out in the Co-Labs, involving people with cognitive disabilities as co-designers and co-developers exploring the efficacy of a range of these tools
- five Hackathons implemented over the project lifecycle which carried out further experiments with the suite of assistive tools, and with the LIVE IT 'Open Toolkit', to deliver

recommendations for changes to assistive tools, ideas for new tools and improvements to the Open Toolkit.

As noted above the lifeworld analysis research work involved 112 individuals, the majority presenting with cognitive disabilities and the remainder involving carers. There was an overall roughly equal split between males and females, but there were variations in the gender balance between the four countries involved in the research, with significantly more females represented in Greece (75%) and Ireland (84%).

Figure 1 shows the gender distribution of the 355 people who took part in the LIVE IT Co-Lab activities and the 200 people who took part in the LIVE IT Hackathons combined. There was no significant difference in gender distribution between the Co-Lab activities and the Hackathons.

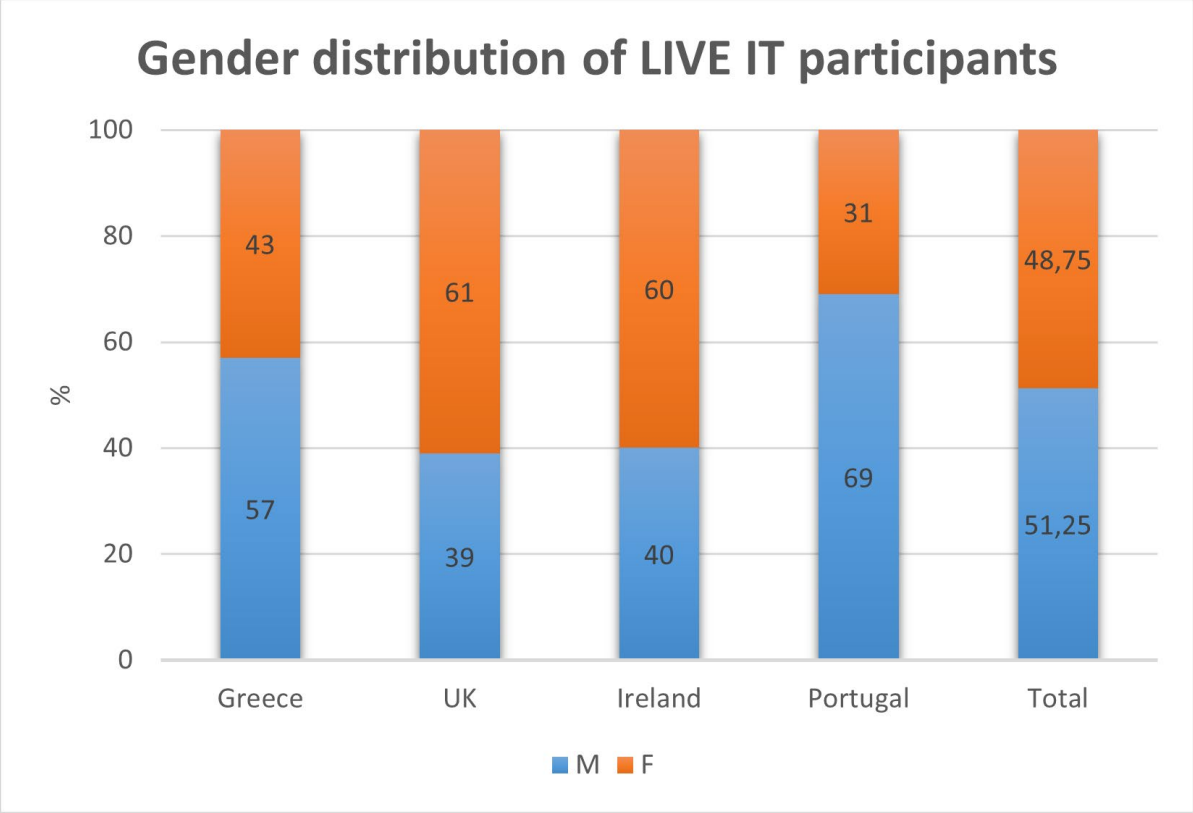


Figure 34: : Gender distribution of participants in LIVE IT Co-Labs and Hackathons

As Figure 34 shows, overall, the gender distribution was slightly skewed against females but almost equal, with 48,75% identifying as female and 51,25% identifying as male. This distribution was reinforced by numbers in Greece. In the UK and Ireland, around 60% of participants identified as female. In Portugal, 69% of participants identified as male.

6.5 GENDER VARIATIONS IN USE OF TOOLS AND THEIR ASSOCIATED OUTCOMES

People with cognitive disabilities participated in 354 experiments with tools to increase web accessibility in the LIVE IT Co-Labs, involving 72 different 'scenarios of use' of the tools, aimed at identifying solutions to digital challenges – for example signing in or completing authentication processes. 200 participants were also involved in exploring the use of tools – and the usefulness of the LIVE IT 'Open Toolkit' – in the Hackathons. These activities and experiments were documented and evaluated using observation, interviews, user surveys and screen capture. In addition, two focused experiments were carried out in the Greece Co-Lab to specifically explore the role of gender in tool use and outcomes.

6.5.1 Survey findings

The surveys used an adapted version of the item System Usability Scale (Brooke, 1986). There are three scales to measure tool usability and usefulness (extent to which the tool/app meets user needs; ease of use of the tool/app; capacity of the tool/app to deliver the tasks required) and four 'semantic differential' scales to measure the user's 'emotional response' (overwhelmed-in control; distracted-focused; frustrated-encouraged; stressed-relaxed). Supplementary open-ended questions capture user perceptions of the challenges encountered using the tools; the things that worked well and the improvements needed.

The survey results were analysed to explore whether variations in the rating attributed to the tools used in the Co-labs and Hackathons could be linked to gender. Figure 2 shows the combined aggregated mean ratings of participants on the tools used, as measured by the seven usability, usefulness and emotional response scales.

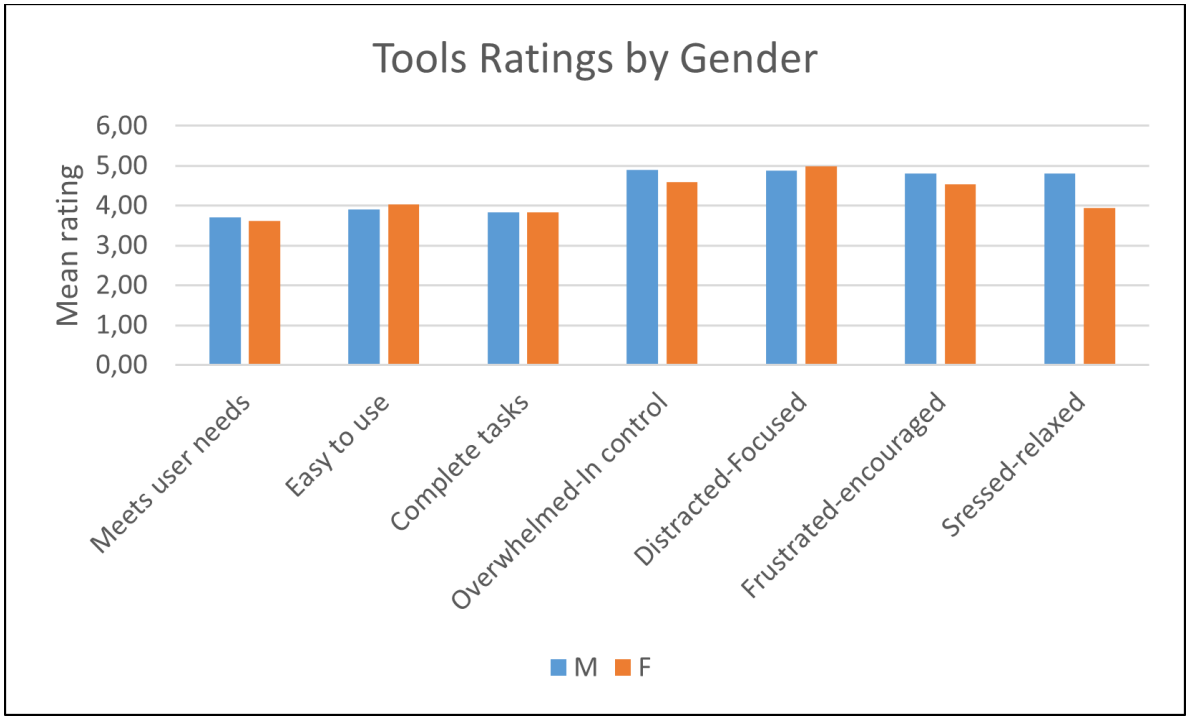


Figure 35: Tool ratings by gender

As Figure 35 shows, the data show only small differences in aggregate ratings for the tools according to the gender participants identified with. A students t-test found no statistically significant differences in ratings across all seven measures between male and female participants.

Figure 36 shows the mean aggregate scores for tool Usability – combining participant ratings on user needs, ease of use and capacity to support task completion – and tool Emotional Response – combining participant ratings on the 'overwhelmed-in control'; 'distracted-focused'; 'frustrated-encouraged' and 'stressed-relaxed' semantic scales – broken down by participant gender identification.

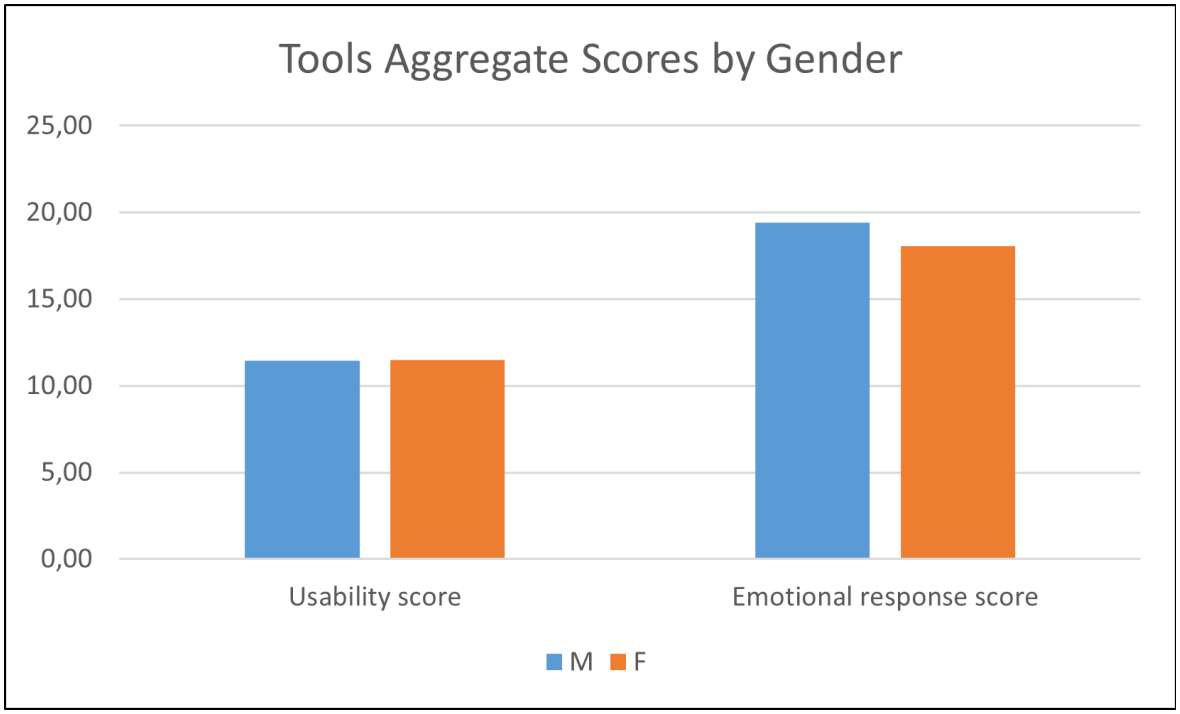


Figure 36: Mean aggregate scores on tool Usability and Emotional Response by gender

Figure 36 shows:

- Female participants rated tool usability slightly higher – a mean of 10.5 – than male participants – a mean of 10.4.
- Male participants rated tool Emotional Response higher – a mean of 19.4 - than female participants – a mean of 18.1.
- A students t-test showed these differences were not statistically significant.

However, although the overall picture on user ratings of the tools explored in the LIVE IT experiments and Hackathons showed no significant differences in terms of gender, some significant differences were identified across the different locations in which these activities were carried out. Figure 37 shows the mean aggregate Usability scores by gender and country location.

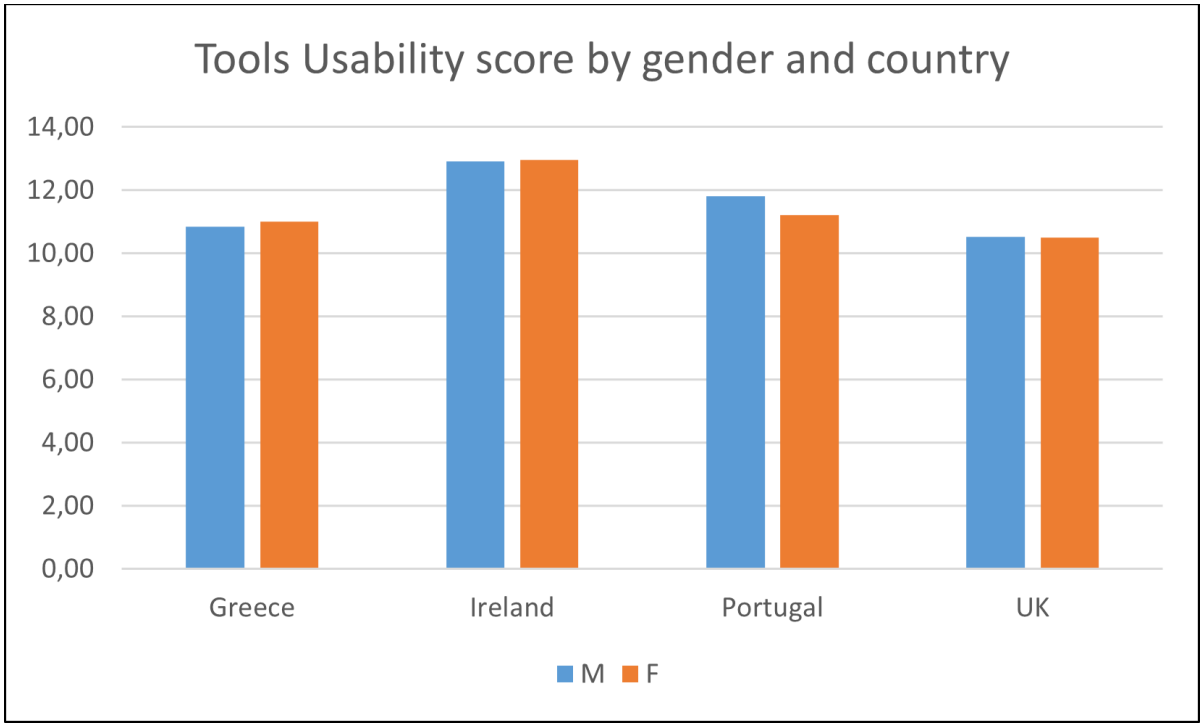


Figure 37: Mean aggregate Usability scores by gender and country location

As Figure 37 shows, across all four country locations, the differences in mean usability scores in terms of participant gender identification were negligible.

However, this is not the case for Emotional Response, as Figure 38 shows.

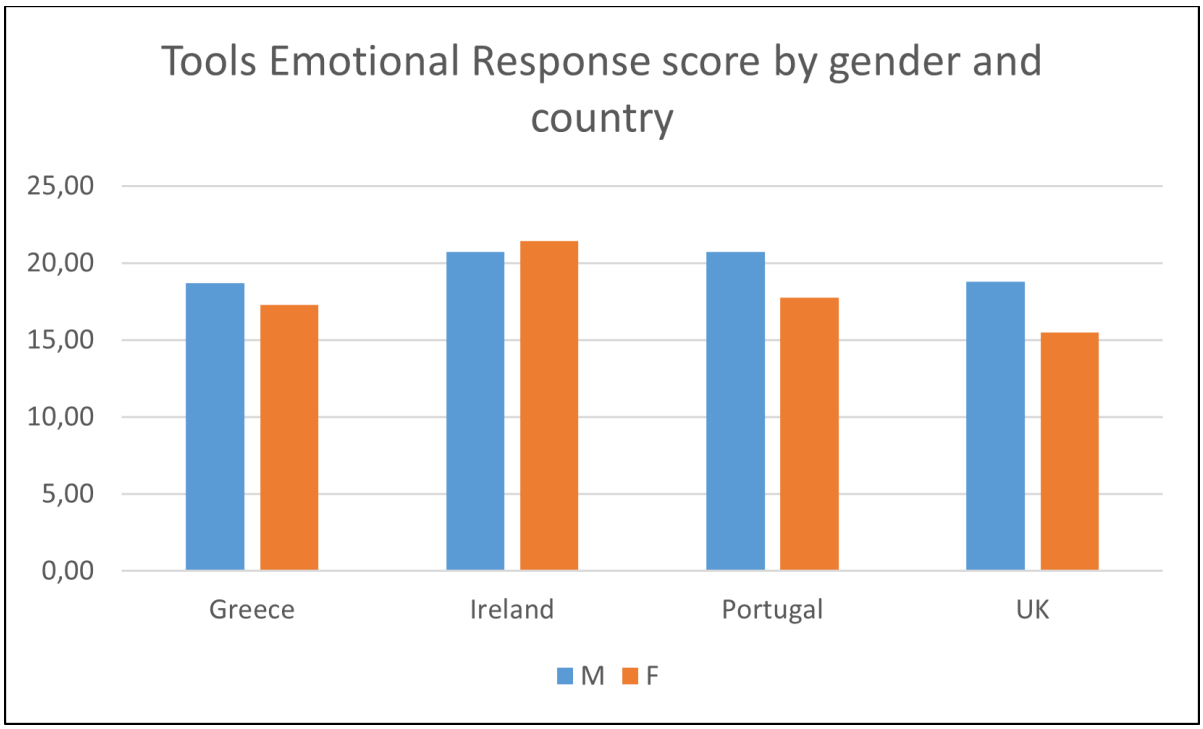


Figure 38: Mean aggregate Emotional Response scores by gender and country location

As Figure 38 shows, participants in Portugal who identified as male gave a higher rating on average on Emotional Response to the tools used – 20.7 – than those who identified as female – 17.8 – a statistically significant difference as measured by a student's t-test (p=0.049). Similarly, in the UK, participants who identified as male gave a higher rating on average on Emotional Response to the tools used – 18.8 – than those who identified as female – 15.5 – although this difference was not statistically significant. There is no clear explanation for these identified differences. The main reason for this is that the survey sample sizes are too small to cross-tabulate gender against location against presenting cognitive disability against type of tool used with any degree of confidence.

6.5.2 Findings from the observation, focus groups and interviews

Analysis of the qualitative data derived from user observation, focus groups and interviews does not provide much additional illumination of the gender dimension in tool use and its outcomes. We found no clear observable patterns of user-tool interaction and behaviour associated with gender across the activities recorded. On the one hand, observational analysis tends to reinforce the picture highlighted above in the discussion of the results of the LIVE IT lifeworld analysis that females are more likely to come into the LIVE IT Co-Labs and the Hackathons with less digital skills and less confidence than male participants. For example, in one of the UK locations it was

observed that females were more apprehensive about what they were letting themselves in for. This attitude was reinforced by the wider skills range – and greater level of confidence – displayed by their male colleagues. However, it was also observed that – in the same location – females were 'hungrier for help and excited about the possibility of help that they'd never received before'. We also found no hard evidence through observation that females used tools in different ways, or that there were different outcomes associated with the use of these tools. The over-riding theme drawn from the observation is that all participants presented with highly variable and specific complex needs. These needs were not obviously mediated through gender – in the sense that females clearly showed a preference for particular tools and gained more benefit from using those tools, and vice versa. However, it seems clear that females brought a particular set of psycho-social and socio-cultural attributes into the LIVE IT activities – centred around factors like previous digital experience, sense of self-efficacy and confidence, as well as particular levels of digital and media competences and that these attributes shaped their subsequent digital behaviours and perceptions of outcomes.

These findings were reinforced by the data drawn from interviews and focus groups. When asked to specify the main challenges encountered using a specific tool or app, respondents gave a range of answers that were not clustered according to participant gender identification. Equally we found no evidence that participants attributed particular challenges encountered to gender characteristics. The same conclusions hold for responses to the questions 'What things worked well about the tool/app?' and 'How could you improve this tool/app?'.

In order to further explore more systematically the role of gender in tool use and outcomes, a data analysis of gender related data (gathered during two sessions of co-lab activities) was made to specifically explore the role of gender in tool use and outcomes. These activities presented some real-life scenarios, involving particular web accessibility challenges, and then asked participants to develop the scenarios with suggested ICT tools. There was no time or other limitation attached to the activity and the procedure was completed with respect to participants' diagnosis and individual preferences and need.

The first co-lab activity involved 10 students with intellectual disability and autism spectrum disorder. Eight students (4 male, 4 female) between 15-20 years old with moderate/severe intellectual disability and 2 students (male), 15 years old with autism spectrum disorder (one with moderate intellectual disability comorbidity) participated. All students had a similar background regarding the use of technology, as measured by self-reported digital competence level, and verified by participating staff (neuropsychologists and sociologists). Participants were presented with the scenarios of interest and the tools selected to explore solutions to them. Participant tool use and outcomes were documented using a structured observation guideline and activity follow-up questionnaire.

Analysis of the data revealed some differences in the use and perceived outcomes of the tools used according to gender. The key findings were as follows. Male students (4) with severe

intellectual disability tended to show more excitement about using the tools and displayed more confidence in using the speech-to-text (S2T) converters than the female participants (4) with similar diagnosis. In addition, female participants seemed to pay more attention to using tools like ContrastChecker, Coloradd-color identification and Visual Keyboard, which were tools that required minimum effort by the female participants. One explanation of this finding could be that S2T ICT tools offered a quick positive reinforcement to male participants, which fulfilled their needs of self-efficacy and subjective competence. On the other hand, female participants did not appear to be animated or excited about the reinforcement and voice feedback provided to their commands; females seemed more animated about the colour functionalities afforded by different ICT tools (e.g., google chrome, Coloradd-color identification, ContrastChecker). They also appeared more responsive to the human interaction provided in the activity (e.g., psychologists who explained the use of an ICT tool) rather than the 'technological' aspects of the tools themselves. Finally, both male participants with moderate severe disability and autism spectrum disorder appeared to use S2T tools and Google Chrome with efficacy and showed strong interest in continuing the scenario (role playing with ICT tools).

In the second experiment five (5) people with ADHD, aged between 30-50 years old, participated in a co-creation session in the Lab of Medical Physics and Digital Innovation, Aristotle University of Thessaloniki. All participants had good knowledge of technology and experience in technological tools as laptops/dekstops/smartphones (moderate to very good, as self-reported and verified by attending neuropsychologists). As with the first experiment participants were presented with the scenarios of interest and the tools selected to explore solutions to them. Participant tool use and outcomes were documented using a structured observation guideline and activity follow-up questionnaire.

Analysis of the data revealed some differences in the use and perceived outcomes of the tools used according to gender. Male participants with ADHD were more animated and excited about tools like Grammarly. In contrast, though they appreciated the functional utility of Grammarly, female participants preferred S2T tools and converters, like NVDA, textfromtoSpeech, Microsoft Speech to text converter, Microsoft Word Dictation and Read-Aloud. Male participants reported they were unlikely to use these S2R tools outside the Co-Lab environment. One explanation for this is that their use would undermine male participants' need to appear competent and in control – especially, for example, in a work setting. This explanation is supported by the finding that male participants showed greater preference for ICT tools like Minimal Consent, Cookie Notice Blocker, as well as the LIVE IT Open Toolkit itself, which were seen as practical. In contrast, female participants were unenthusiastic about using Blockers but valued digital organisers like Google Calendar, Microsoft To Do List and Microsoft Whiteboard. It's important not to read too much into these findings – particularly given the small population involved. However, they do support the findings from the survey, observational, focus group and interview data, as well as the results of the first focused gender experiment reported above in that user behaviours seem to reflect psycho-social and socio-cultural differences that are mediated through gender. Males in this

second experiment seem to prefer tools that reinforce their sense of self-efficacy and competence – for example valuing Grammarly as a way of correcting their mistakes, thereby amplifying these self-perceptions. Females gravitated more to S2T converters, which appeared to instil for them a sense of being guided, supported and looked after. Equally they valued organising and planning tools that appeared to contribute to creating an ordered and manageable environment, one that is perhaps seen as an antidote to a lived experience that is often challenging and sometimes scary.

6.6 CONCLUSIONS AND IMPLICATIONS

6.6.1 Key conclusions

The key conclusions of LIVE ITs work on the gender dimension are as follows.

- Our over-arching review of the literature highlighted the complexity of the relationship between gender, cognitive disability and digital accessibility. On the one hand there is an evidence base that links gender to patterns of cognitive disability – as evidenced by studies that show Autism Spectrum Disorder (ASD) has a higher prevalence in males compared to females. Similarly, there is some evidence that females are more likely to present with co-morbidity issues – for example females presenting with ADHD are more likely to experience issues throughout life associated with lower life opportunities. Equally there is an established evidence base that shows females are more likely to experience 'dual exclusion' – less access to digital tools and services and the training needed to use them effectively, leading to reduced digital and media competences and a lower 'quality of digital life', which in turn exacerbates economic and social vulnerability.
- However, there is very little compelling evidence on the relationship between cognitive disability, gender and the use of digital and media technologies. Some studies suggest that some digital tools may be more effective in supporting people with cognitive disability depending on their gender, and on the presenting cognitive issue. But the evidence is patchy and sometimes contradictory. More broadly, research on 'intersectionality' – which aims to explore the interlocking systems that define the lives of excluded and marginalised people, and particularly the role of gender in these interlocking systems – suggests that digital life is mediated through sex and gender and the ways in which these two factors are 'entangled' with factors like ethnicity, economic situation and lifeworld. Females and people with cognitive disabilities who identify as non-binary occupy complex, intersectional spaces in multiple, interlocking communities that in many ways are disconnected from 'mainstream' digital life.
- The findings from LIVE IT's 'baseline' research – which included a focused systematic review on web accessibility for people with cognitive disability, an 'interventions audit' of tools and other interventions aimed at supporting people with cognitive disabilities, together with a detailed exploration of how digital life is experienced through everyday life

– carried out using 'lifeworld analysis' – reinforce the picture painted in our general literature review of a field that is complex, contradictory and lacking an established evidence base. We found no examples of policies, guidelines or tools that specifically focused on gender. However, the results of the lifeworld analysis reinforce the impression drawn from the literature that 'intersectionality' defines the digital life of female and non-binary people with cognitive disabilities. A persistent narrative identified in the lifeworld analysis told the story of women whose cognitive disability was mis-diagnosed or not taken seriously in early life; who subsequently experienced feelings of inadequacy and low self-confidence; whose life opportunities – including access to digital tools and training – were significantly constrained and who ultimately end up excluded from the digital world.

- Turning to the subject of gender representation in LIVE IT, the upwards of 500 people who took part in the project activities – including lifeworld analysis, the experiments carried out in the project 'Co-Labs' and in the series of Hackathons implemented - show a broadly equal split between males and females, although some variations in gender balance were identified between the four participating countries. It is worth noting that no participant involved identified as non-binary.
- In our evaluation of these project activities, we looked at the role of gender and in particular whether variations in the use of tools within the Co-Labs and Hackathons – and the outcomes associated with the use of tools – can be linked to gender. This was done through observation, including screen capture, interviews, user surveys and focus groups, as well as data analysis of the gender related data from two co-lab sessions to specifically explore the role of gender in tool use and outcomes.
- The results of the user surveys revealed very little difference overall in how participants' rated digital tools to support web accessibility on the key measures of 'usability' and 'emotional response' according to gender, although, in Portugal, males gave a higher mean aggregate rating on the combined tools used in the experiments on 'emotional response' than females – a statistically significant difference.
- Analysis of the qualitative data derived from user observation, focus groups and interviews did not provide much additional illumination of the gender dimension in tool use and its outcomes. We found no clear observable patterns of user-tool interaction and behaviour associated with gender across the activities recorded. However, the data analysis did reinforce the picture highlighted by the LIVE IT lifeworld analysis that females are more likely to come into the LIVE IT Co-Labs and the Hackathons with less digital skills and less confidence than male participants. This did influence to some degree their expectations about using the tools in the experiments, their selection of particular tools and their evaluation of those tools.
- We found that males showed a preference for and were more likely to positively evaluate tools that reinforced their sense of self-efficacy, control and competence. In contrast,

females showed a preference for and valued tools that were seen as safe, structured and supportive. In addition, they valued the human support provided by the staff involved in the experiments – in particular the help they were given on using the tools and the encouragement and confidence-building offered.

6.6.2 Implications for the future

The implications of these conclusions for work in the field of supporting web accessibility for people with cognitive disabilities going forward are as follows.

- The strongest key message from the above conclusions is that we don't know nearly enough about how gender is interweaved with cognitive disability and web accessibility. Most of the evidence base is in three different strands: cognitive disability, gender and digital accessibility - and these strands remain disconnected. There are some signs that some tools to support digital accessibility may be more effective for some men or some women – as evidenced by the handful of studies in the literature and our own research in the Co-Labs, reported on above – but these remain signs only. A more intensive, broader, more comprehensive and more systematic research effort is therefore needed to connect the dots between gender, cognitive disability and digital accessibility.
- Two areas are strong candidates for this increased research effort. First, on how 'intersectionality' works in this field. This needs to focus in more detail on how sex and gender combine with dynamics like ethnicity, economic situation, family background and presenting cognitive disability to shape access to, use of and benefits derived from digital tools and services. Second, research is needed on whether and in what ways particular tools to increase web accessibility work differently – and are more effective – for different sex and gender categorisations and typologies.
- Both areas imply more innovative research methodologies, methods and tools. In the case of 'intersectionality' research a more robust quantitative approach – involving larger population sizes across different categorisations and typologies – needs to be combined with more novel 'qualitative' and 'ethnographic' approaches. For example, LIVE IT has demonstrated that lifeworld analysis can be a powerful tool to reveal the specificity of the lived experience of cognitive disability through the prism of gender. Other tools – for example video ethnographies and blogs and, more broadly, participatory action research, could add significant value to lifeworld analysis and could have the added benefit of increasing participants' digital and media competences.
- In the case of research to establish whether and in what ways there is a connection between gender and tool efficacy, what's clear from LIVE IT's own research in its Co-Labs and Hackathons is that the complex potential inter-relationships between variables of interest in a typical experiment – for example presenting cognitive disability, experimental scenario and challenges covered, tool attributes, delivery mechanism and gender – are

likely to test the limits of conventional models and methodologies – particularly in the typical case where experimental populations are small. We therefore need much bigger experimental populations and more sophisticated data capture and analysis tools – which brings into play the potential opportunities afforded by AI and machine learning. It's likely that only AI and machine learning tools would have the capacity to identify and make sense of interactions and 'causal relationships' between tool attributes and user behaviours, so as to develop clusters of attribute-use behaviour combinations that demonstrate the best potential outcomes for inclusive web accessibility.

- In addition – as demonstrated by the literature reviews and our own experience of recruiting and engaging participants in Co-Labs and Hackathons – the voice of some representatives of the gender spectrum in research is almost silent. Although LIVE IT achieved a broad parity of sex representation in its activities, representation of people with cognitive disabilities who do not identify as binary was not achieved. People whose gender identity is non-binary need to be better represented in research going forward.
- Despite these clear research and evidence gaps, we do know something, from LIVE IT's work, about how the interactions between cognitive disability, gender and digital accessibility are likely to pan out. For example, it seems clear that females bring with them less knowledge, skills, confidence and aspirations to the digital table. In the context of the here and now of designing and delivering effective policies, approaches and tools to support web accessibility for people with cognitive disabilities this suggests some lessons that could be learned and applied. One is that active support for females needs to be built in across the whole IT design, delivery and implementation process. One keyway this could be done is to provide more extensive and comprehensive training in digital and media skills for females with cognitive disabilities. Another way is to increase the representation of females – and people who identify as non-binary – in positions of advocacy, leadership and decision-making across the board, from design and development in the IT sector, through standards bodies, to policy-making agencies.
- However, it is clear from our results that there is no quick fix. There is no technological silver bullet that will at the touch of a screen icon magically transform the lives of female and non-binary people with cognitive disabilities. The roots of gender inequalities in access to, use of and benefits derived from digital tools and services for people with cognitive disabilities are embedded in the complex intersectionalities through which disability, gender, ethnicity, education and economic position mutually interact and reinforce inequalities. So, you start with revealing and interrogating the roots of structural inequalities and work upwards from there – for example, as noted above, recognising that women with cognitive disabilities are more likely to be less digitally competent, less confident about using technologies and more in need of support. This support needs to be provided across the spectrum, from improving digital and media skills training for females

and non-binary people with cognitive disabilities, through embedding functionalities within tools that reflect their needs, to providing tailored support to help them utilise tools more effectively and in line with their needs.

- This last point brings into play a broader implication for web accessibility for people with cognitive disabilities going forward. Given the complexity of intersectional dynamics and the variability of tool use and outcomes within the context of gender, it seems clear that the main lesson for tool designers, developers and service delivery entities is to support customisation and personalised use. All participants involved in LIVE IT activities presented with highly variable and specific complex needs. These needs were not obviously mediated through gender – in the sense that females clearly showed a preference for particular tools and gained more benefit from using those tools, and vice versa. But gender brought a particular set of psycho-social and socio-cultural attributes to the table, centred around factors like previous digital experience, sense of self-efficacy and confidence, as well as particular levels of digital and media competences - and these attributes shaped their subsequent digital behaviours and perceptions of outcomes. This supports a need going forward for improving customisation and personalisation in design, development and implementation. On the one hand, this implies increased human support for users. On the other it implies a potential role in the future for machine-learning agents that learn from user behaviours in order to adapt tools more closely to user characteristics and needs.

7 DIAGNOSES' SPECTRUM IN LIVE IT

7.1 MAKERSPACE AND HACKATHONS

Throughout the reports and deliverables of the LIVE IT project descriptions of participants in the project activities, many disabilities were addressed and described. Most of the participants in the makerspace do not register or inform if they are a Person with Cognitive Disabilities, an expert or professional in the field, or simply as someone who has interest in the field, therefore this kind of data is not available or collected as regards to the Makerspace.
As far as the Hackathons are concerned, a total of 38 teams / participations in 5 Hackathons, come from:

Origin	**Teams**
Ireland	5 teams
UK	7 teams
Portugal	11 teams
Greece	14 teams
Design for All Europe	1 team
	38 teams

The allocation of teams' participation in the 5 Hackathons is as follows:

Hackathon	Teams
1st Hackathon	6 teams
2nd Hackathon	9 teams
3rd Hackathon	12 teams
4th Hackathon	4 teams
5th Hackathon	7 teams
	38 teams

In terms of teams, countries and diagnosis participating in the Hackathons the data is as follows:

Greece

Hackathon	Country	Team	Diagnosis
1	Greece	EEEEK Alexandreias	Down syndrome, motor skills disabilities
1	Greece	AMEN organisation	Dementia, Alzheimer, Aged related Cognitive decline
1	Greece	EPSEP Ioannina	Dementia, mild cognitive impairment
1	Greece	Promesip	Experts, researchers
2	Greece	AMEN organisation	Dementia, Alzheimer, Aged related Cognitive decline
2	Greece	Promesip	Experts, researchers
3	Greece	EEEEK Alexandreias	Down syndrome, motor skills disabilities
3	Greece	Promesip	Experts, researchers
3	Greece	EPSEP Ioannina	Dementia, mild cognitive impairment
4	Greece	EPIONI	ADHD
5	Greece	AMEN organisation	Dementia, Alzheimer, Aged related Cognitive decline
5	Greece	NIMIA	Experts, researchers

Portugal

Hackathon	Country	Team	Diagnosis
1	Portugal	ADFP	Cognitive Deficit, ADHD, ASD
2	Portugal	ADFP	Cognitive Deficit, ADHD, ASD
2	Portugal	CECD	Intellectual Disability
2	Portugal	CBN	ASD, ADHD, Anxiety, Intellectual Disability

3	Portugal	ADFP	Cognitive Deficit, ADHD, ASD
3	Portugal	CECD	Intellectual Disability
3	Portugal	CBN	ASD, ADHD, Anxiety, Intellectual Disability
4	Portugal	ADFP	Cognitive Deficit, ADHD, ASD
5	Portugal	CBN	ASD, ADHD, Anxiety, Intellectual Disability

Ireland

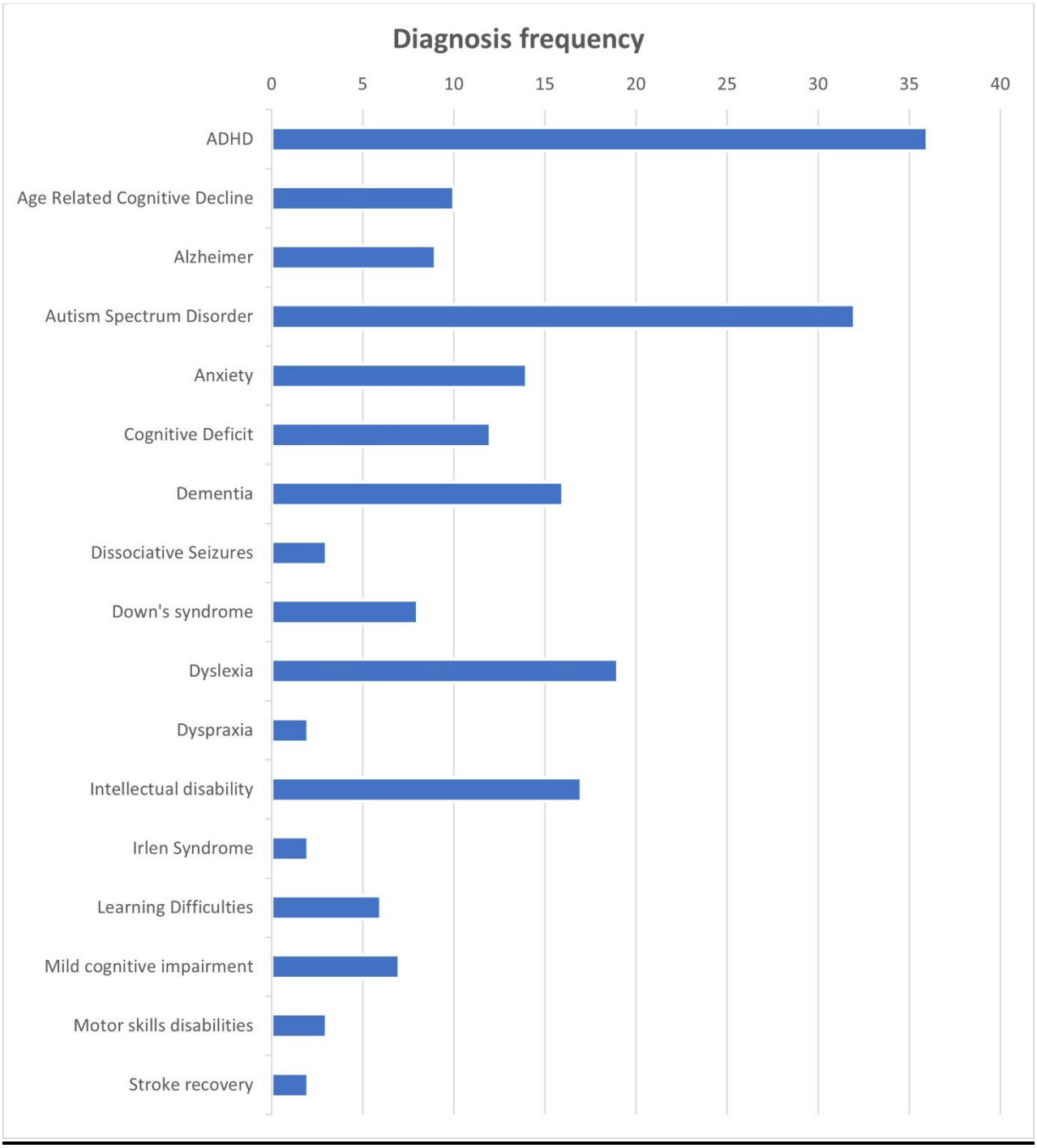
Hackathon	Country	Team	Diagnosis
1	Ireland	2nd Level student	Dyslexia
2	Ireland	University students	ADHD, Dyslexia
3	Ireland	NUIG access centre, FIT ICT talent pipeline and Dyslexia Ireland	Experts
4	Ireland	Special education teachers	Experts
5	Ireland	3rd level students	Dyslexia, ASD and ADHD

UK and EIDD

Hackathon	Country	Team	Diagnosis
2	UK	Bristol co-creation lab participants	Dyslexia, ADHD, ASD
3	UK	Bristol co-creation lab participants	ASD, Dyslexia, ADHD, Learning Difficulties
3	UK	Neurodiversity Learning	Dyslexia, ASD, Learning Difficulties, ADHD
4	UK	Bristol co-creation lab participants, SCT and A2ndVoice plus	ASD, Dyslexia, Dissociative Seizures, Dyspraxia, Age Related Cognitive Decline, Stroke recovery, Irlen Syndrome, Down's syndrome
5	UK	Individual	PwCD (IT Expert)
5	UK	Bristol co-creation lab participants	Dyslexia, ADHD, ASD
5	EIDD	Working Group	PwCD, a web designer and a web developer

Total Numbers per Diagnosis

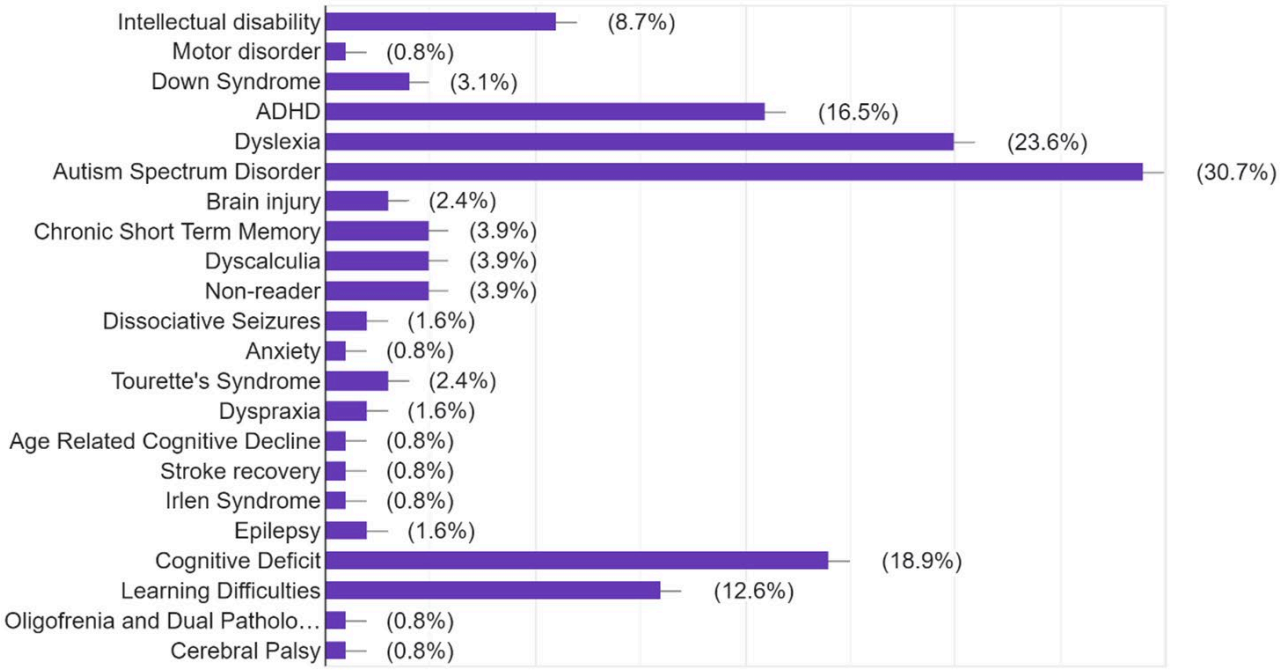
Diagnosis	Frequency	Ap. Persons
ADHD	16	36
Age Related Cognitive Decline	4	10
Alzheimer	3	9
Autism Spectrum Disorder	15	32
Anxiety	5	14
Cognitive Deficit	4	12
Dementia	5	16
Dissociative Seizures	1	3
Down's syndrome	3	8
Dyslexia	8	19
Dyspraxia	1	2
Intellectual disability	5	17
Irlen Syndrome	1	2
Learning Difficulties	2	6
Mild cognitive impairment	2	7
Motor skills disabilities	2	3
Stroke recovery	1	2
Total	78	198


Diagnosis frequency
0
5
10
15
20
25
30
35
40
ADHD
Age Related Cognitive Decline
Alzheimer
Autism Spectrum Disorder
Anxiety
Cognitive Deficit
Dementia
Dissociative Seizures
Down's syndrome
Dyslexia
Dyspraxia
Intellectual disability
Irlen Syndrome
Learning Difficulties
Mild cognitive impairment
Motor skills disabilities
Stroke recovery

7.2 CO-LABS

The following graph shows the range and representation of different diagnoses of participants in the LIVE IT project activities.

Diagnoses



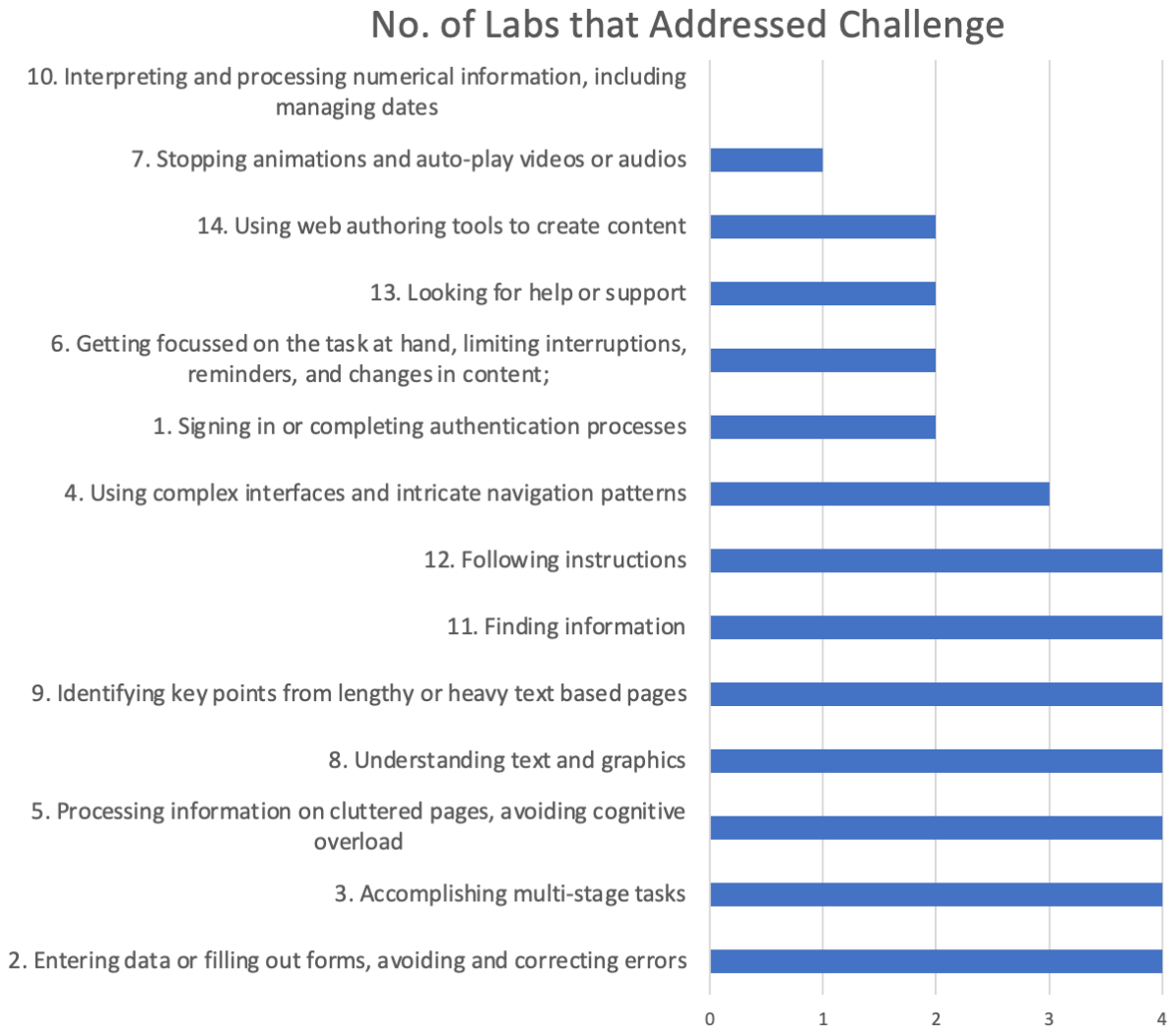
8 GENERATED RECOMMENDATIONS AND GUIDELINES

8.1 RESEARCHERS

The LIVE IT Project accomplished a lot across the four co-design labs in just 12 short months. However, we could not address all web accessibility challenges faced by people with cognitive disabilities in the time we had available to us. The chart below illustrates the extent to which the 14 challenges highlighted by the LIVE IT as essential to address were able to be addressed in the co-design lab sessions. We recommend that researchers use the LIVE IT validated scenarios as a starting point to investigate the following:

1) Web accessibility solutions for interpreting and processing numerical information. LIVE IT co-design labs were able to observe the difficulties faced by people with cognitive disabilities when

accessing numerical web-based content such as tables and data dashboards. However, no suitable solutions were **identified.**



Supporting Data from Co-Labs:
20-year-old, female, third level student with dyslexia – “Yeah, it really would just sound like nonsense. Like, sometimes it would be like…um…it wouldn't even read some of the symbols, like. Then at different times to be like, “Arrow to the right.” When it would be something completely different. And Microsoft Edge…it was…some of it was a bit funny…but generally, it was a bit better to handle it. And then…because with ReadWrite Gold as well, if there was an equation, it could skip past it completely, and then when it got to the end of the page, it would go back and do it again. So didn't really follow in sequence.” (Interview, Irish Co-Lab)

2) Web accessibility alternatives to text. We live in a text-dependent society, and alternatives to text that maintain the same amount and quality of information as a particular text are needed. The majority of the LIVE IT Project participants struggled with text in some way, and this is not a new phenomenon in the research. However, alternatives to text that are useful and relevant for people with cognitive disabilities still need attention and improvement.

Supporting Data from Co-Labs:
L and M (21 and 15, Autistic, "text avoiders" if possible) - Both sisters use social media and visual sites. They are distrustful and avoid heavy text-based material. Need lead in and slow introductions to new things, image-based signposting if possible. Concerned about difference, mental health, exclusion and online safety. (Fieldnotes, UK Co-Lab)

3) Web accessibility solutions via virtual reality. Participants frequently imagined virtual reality solutions to the challenges that they face using the web in their day-to-day lives. Researchers can use the LIVE IT Scenarios as a starting point for exploring the affordances of virtual reality. Alternatively, they can start their own participant-driven inquiry cycles!

Supporting Data from Co-Labs:
Need visual signposting and non-stressful introductions. Some experience severe stress and anxiety when presented with anything computer based. General enjoyment of computer games and visuals, roblox and similar. Prefer the physical world and face to face. Zoom, Facetime, WhatsApp and video calling popular when f2f not possible. All express concerns with Digital Access and relevance. (Fieldnotes, UK Co-Lab)

Several UK hackathon teams proposed virtual reality as a means for making the online world more accessible. (Presentation, **Link**)

4) Immediate and imaginative solutions for PDF accessibility. The importance of PDF accessibility will be mentioned many times in this report. Researchers must devote attention to creating immediate and imaginative solutions for PDF accessibility.

Supporting Data from Co-Labs:
Participant K-a (Dyslexia, auditory, spatial and colour processing issues) -Read and Write good, Windows and Apple inbuilt tools useful. Has her own tools - Dragon, Grammarly Pro, also uses TextHelp and other similar software. Apple accessibility software also good. Uses block separators, mindmapping and font colour and background colour settings to help with colour processing disorder, also has spatial and auditory processing issues. (Fieldnotes, UK Co-Lab)

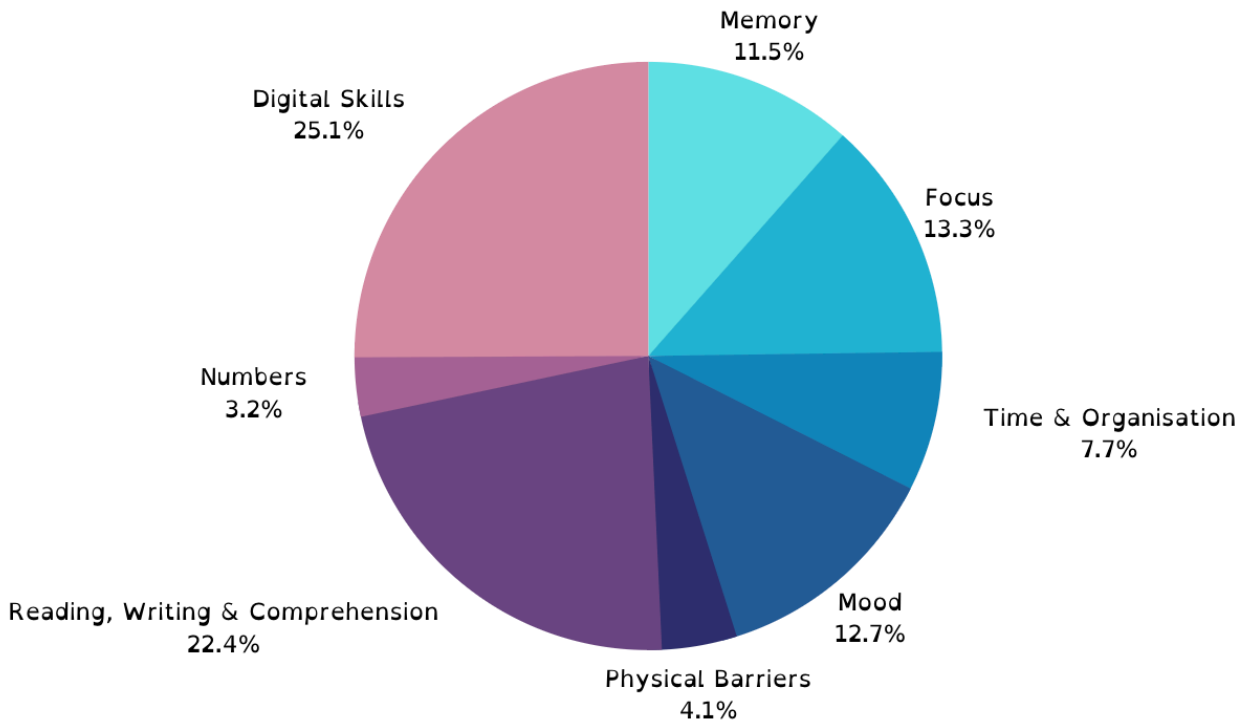
33-year-old, female, third level student with dyslexia – “T2S could not read the text in the PDF for me. And it took me a week to read it because it was in columns, and it was tiny letters that were distorted. And it took me about a week to read it with comprehension.” (Interview, Irish Co-Lab)

8.2 POLICYMAKERS

The LIVE IT Project participants with cognitive disabilities described and demonstrated a multitude of web accessibility challenges throughout the lifetime of the project. The chart below shows an overview of the challenges reported and/or demonstrated by participants by category. *Digital Skills* and *Reading, Writing and Comprehension* were the most frequently reported and/or demonstrated challenges. Therefore, the LIVE IT Project makes the following recommendations for policymakers:

1) Introduce and/or further support policy that fosters the development of digital skills in an inclusive and accessible way. Policymakers should include people with cognitive disabilities in the planning and implementation of such policy.

2) Develop and support policy that encourages the de-facto integration of non-text-based methods for communicating information at the same amount and quality as would be communicated via text. Again, policymakers should include people with cognitive disabilities in the planning and implementation of such policy.



Supporting Data from Co-Labs:
Participant J (18 - Dyslexic, Dyscalculia, colour and other processing issues – possibly Autistic – can't read) - "Colours eat the words. I can't read. Likes visual sites such as YouTube." (Fieldnotes, UK Co-Lab)
Only able to use and interested in YouTube and musical or image-based sites. Significantly challenged around logging on and access due to severe reading difficulties and associated anxiety. Needs help multiple times a day with logging on to SCT open access computers that require the input of a user id. Lo struggles to accurately copy username and passwords into log on fields and doesn't appear to realise when she has typed in incorrect characters or symbols. Password managers are not useful in this sort of public pc use scenario. (Fieldnotes, UK Co-Lab)

20-year-old, male, third level student with ADHD and speaks English as second language – "Normally, what I would do is…for example, in an assignment, I need to do certain tasks. The first thing to do is if I don't know a certain concept, is just to quickly look it up on Wikipedia. From that, I just kind of like…uh…understand the main idea that is there. Then, I look it up on YouTube…for the same concept…as a description. There's nearly every single time a concept described in a certain way. And there's…at least in coding…tons of tutorials. So, in coding, it's a little bit easier, because there is a lot of concepts that are going to be easily available. Not even just tutorials…you have some blocks of code that you can just copy and paste, and it's explained quickly. However, with all other things, there's either going to be some YouTube videos, or some related content

that just gets you like, kind of close. If that happens then, I have to go back to Wikipedia and just read until I understand *everything*. From that I could go back to the lecture, either notes, or just text. And then because I already know the 90% of the concept, I understand everything quite quickly. And then it takes less time, which is kind of like paradoxical because I just took around half an hour just researching everything…for just looking at…or to be able to read two pages." (Interview, Irish Co-Lab)

3) Support web accessibility with funding for training designers and developers. Standards and guidelines are not enough. All the data from the LIVE IT Project supports that claim. High quality web accessibility standards already exist, but designers (everyone from teachers to the researchers working on this project, to a small business owner creating a website, to professionals in web design) and developers (amateur, professional, and everything in between!) are constantly creating content, websites, PDFs, and applications that are not compliant. Additionally, the standards are continuously improving, which is a good thing, but that means the goal posts for accessibility are continuously moving. Funding for high quality, open access, and freely available training on how to create accessible web content is urgently needed.

4) Support web accessibility with funding for consistent and immediate PDF compliance. The European Union is committed to increasing equity in education and employment. One of the largest gatekeepers to education and employment is the ability to access and read PDFs. To support accessibility and equity in this area, a coordinated and well-funded effort to make all PDFs accessible as soon as possible.

Supporting Data from Co-Labs:
20-year-old, female, third level student with dyslexia – "Um…I mean, my least favorite part is reading papers. So, I just wish that there was a way that making them easier to read would be a thing, but like, obviously, you can't just magic my brain to work like normal brain. Um… something that makes it easier. Probably, yeah. Having, like, a proper tool that would read the articles aloud. Like, one that just works." (Interview, Irish Co-Lab)

33-year-old, female, third level student with dyslexia and speaks English as second language – "It has a lot of glitches, so I only use the screenshot. But then I must manually mark the text that I want to read. And sometimes when it…there's like a picture in the middle of the text…and instead of marking the whole chunk if the picture has description, I must mark the chunk above mark the chunk next to the picture and mark that chunk below. And I cannot put it…I use…let's say for the longer texts that I can download in PDF I use the natural reader instead of text to speech. But that one has other glitches. So, the problem is recently, it's not recently about a year ago, it started ignoring everything that is in brackets. Okay. I can play it for you. I have one text here that it's…it's kind of It sounds weird when you read it." (Interview, Irish Co-Lab)

5) Support web accessibility with funding for open access and free tools. The European Union is committed to increasing equity in education and employment. Another major gatekeeper to education and employment is the ability to access necessary features of all tools. Many tools, or elements of tools, exist behind a paywall. This further excludes those who need to use the tools to gain access to education or the economy.

Supporting Data from Co-Labs:
32-year-old, female, third level student with dyslexia – "I think like a lot more open access kind of stuff. I mean, it's great for me I'm at the university and I can get everything, and you know, through that. But I mean a lot of people aren't and I think it really would benefit their lives to be engaged in this kind of…to know what's available to them…and is well…yeah to know what's available as well as open access so that's the big thing." (Interview, Irish Co-Lab)
Many tools were not free. *"Ohhh good idea… but not free of charge"*; *"Nice tool but we need to pay to access it"* (Fieldnotes, Greek Co-Lab)

Finally, based on what we have learned from the work done in the LIVE IT co-design labs and the baseline research conducted prior to implementing the labs, automated accessibility checkers are a great start but cannot be the only method for assessing web accessibility. Thus, we recommend that policymakers:
5) Develop and support policy that provides for continuous web accessibility assessment and improvement by and with people with cognitive disabilities. The LIVE IT scenarios can serve as an example of how to do this type of work with people with cognitive disabilities.

8.3 DESIGNERS AND DEVELOPERS

The most useful aspect of the LIVE IT Project for designers and developers is likely the website housing all the hackathon presentations. The hackathon presentations include the dreams, recommendations, and proposed web accessibility solutions developed by people with cognitive disabilities. This website was created by one of the UK Co-Lab participants, Julia. To view the hackathon presentations, follow this link: **Link**
1) Create accessibility tools that function in all European Union languages. One of the most common challenges faced across all project labs and hackathons was the inability of most tools to function in the desired language. Tools are created with an English-as-default perspective, and the European Union requires a different perspective.

Supporting Data from Co-Labs:
33-year-old, female, third level student with dyslexia – "The Irish part of it. It's just if the text is something that it does not recognize, then it then it compares it to the nearest thing that it thinks it is." (Interview, Irish Co-Lab)

Portuguese hackathon teams consistently provided feedback that they could not use existing tools because the tools did not function in Portuguese. Their presentations can be found by following this link: **Link**
Greek hackathon teams and co-lab participants could not use existing tools because the tools did not function in Greek. (Fieldnotes, Greek Co-Lab)
Most of the tools of the Toolkit where in English, so they were unsuitable for use in the Greek population of PwCD. *"The problem is we cannot use many of the tools because they are in English and our people are not going to understand the guidelines, the use, even with us beside them"*; *"Excellent tool, but the problem is that it is only for English speakers"*; *"If only it was in Greek…"*; *"We tried it but it was in English, so it was not useful enough for us"* (Fieldnotes, Greek Co-Lab)

2) Create PDF accessibility solutions. We acknowledge that PDF accessibility has received a lot of attention, but PDFs are still largely inaccessible.

Supporting Data from Co-Labs:
One of the UK hackathon teams addressed PDF accessibility in their hackathon presentation. The presentation can be found by following this link: **Link**

The accessibility recommendations to be applied to create accessible digital projects are aggregated in the following list:

- Maintain clear contents, use simple layouts, leave spaces between elements, use not much text, try to include visual or audio supporting
- Consider people that do not speak English, but either way use always plain language
- Ensure ease of navigation / guide users to what is the required action from them and what they should do / how they should act
- Tools should be accessible from start to finish, meaning that the installation process and optimization / setting procedures should also be accessible
- Create free tools, ad-free, accessibility should not facilitate only people able to pay – including updates
- Ensure dictation is working, especially with people not being able to pronounce / articulate perfectly
- Create tools to facilitate interpretation and processing numerical information, dates, tables, calculation and other complex forms of content
- Create tools that are easy to use / easy to follow – direct users to next steps
- Create a cross-platform button that enables text-to-speech or dictation features
- Create tools that can generate abstracts from long dense contents
- Create tools that can read lips to facilitate direct conversations
- Create tools that blur background to help users focus on text reading
- Create tools that provide the feature of profile setting according to challenges or per diagnosis and customise all digital content according to profile selected

- Create tools that can remove, blur, or hide media such as pictures, ads, videos or animations
- Create tools to facilitate PDF accessibility and compliance to standards and protocols
- Create a virtual assistant that can be adjusted based upon different diagnoses, for example when a user faces memory challenges, the virtual assistant could be used as a reminder, when there are reading problems, the virtual assistant could easily read content on screen by just pressing a button
- Create tools with no errors, bugs – it confuses PwCD more and makes them feel responsible for the error
- Too many options and elements may as well be confusing, especially when not presented simply
- Integrate visual / layout tools with text-to-speech tools to motivate users to read along readers
- Make tools compatible with most browsers / operating systems
- Readers' speed should be adjustable when not already
- Readers should use more human voices and not robotic digital voices
- Text-to-speech tools should integrate translation mode for live translations
- Use audio / visual elements and instructions to support text-based content
- Use chatbots or helpdesk and FAQ whenever possible
- The harder the disability, the harder the solution needed, nevertheless it should be aimed
- Digital skills acquisition is important for caregivers that often act as mediators / training delivery provision to caregivers, but also offering of know-hows and tutorials to end-users
- PwCD are still dependent to their caregivers to interact with existing tools but that should change - self-esteem, independency and privacy issues are caused by the required constant presence of mediators to digital interactions
- The digital world must move towards an environment where accessibility tools would be pointless and useless – the digital world should be accessible without tools and assistants.

8.4 STAKEHOLDER - GENERATED RECOMMENDATIONS FOR DESIGNERS AND DEVELOPERS

Additionally, Pete Kercher, a UK-based LIVE IT supporting community-based partner, created a list of recommendations for the project partners. Pete's recommendations for designers and developers are copied below.

Recommendations for Designers, Developers and Decision Makers
Although the principle stated focus of the LIVE IT Project was to provide input that may be of use in guiding the future work of the policy makers who sit in the European Parliament and, to a secondary extent, of researchers preparing to embark on more detailed research projects designed to build on the foundations sketched out in the short time available during the project's lifetime, practical experience learned from practitioners who have been working for decades in the area of Design for All suggests that it would not be out of place to state some basic principles also in respect of the theory and working practice of designers, developers and decision makers.

Designers: The scenarios envisaged during the LIVE IT project focus on situations that can currently be considered to be substantially rather rare. As a consequence, they are usually treated as marginal when designers approach issues of mainstream usability. This is a self-perpetuating problem, however, in that their relevance to mainstream projects is dangerously underestimated in everyday design and implementation work, not only in the field of the relationship between people with cognitive disabilities and online media, but across the board, in the field of how people with any form of disability, whether physical or cognitive, relate to the artificial environment in which we all live to a greater or lesser extent.
The recommendation offered to practising designers in the light of the many years of experience of Design for All (represented by its ambassador Pete Kercher who was a subcontractor of LIVE IT) is that they study these scenarios with care, so as to employ the lessons that can be learned from them as extreme-case situations, whose inclusion in a mainstream design process is posited as the litmus test for true inclusion.
Rather than merely copying these scenarios, however, designers are invited to embark on a coherent process of user involvement, in accordance with the methodology of Design for All, as quoted in the Stockholm Declaration (**link**), which states that "Design for All is design for human diversity, social inclusion and equality", then goes on to expound on the methodology with these words: "The practice of Design for All makes conscious use of the analysis of human needs and aspirations and requires the involvement of end users at every stage in the design process". This entails not only analysis, but a constant iterative process of consultation with those users who experience the most challenging situations in their interaction with the objective of the design process, since the ability to include such cases has been found to generate results that are also convenient, easier to use and thus beneficial to all mainstream users.

Developers: Every design process is a multifaceted partnership: while the designer acts as the leader of the process, the figure of designer should never be considered to be the sole figure of relevance. Just as an automobile designer would remain a theorist in the absence of the engineers who lend their expertise to translate the draft design into functioning models of good engineering, so a software designer must work in partnership with software developers and web designers must involve not only the end users mentioned in the previous section, but also the developers who work behind the scenes to codify the instructions elaborated by the designers.
Once again, the accent here is on conveying also to developers the important message that the scenarios experienced in the – albeit short – lifetime of the LIVE IT project are of vital interest when applied in a sense that is not sectoral, so does not focus solely on the specific user groups in question, important though their needs are, but mainstream in nature, in compliance also with the principles of Design for All.

Decision Makers: Decision makers are the third vital element of this trio: without their awareness, understanding and active participation, no truly inclusive design process can take place. The reasoning is straightforward: however good the designers, however competent the developers, the decision to give both figures the correct amount of freedom necessary to create a coherent inclusive design process rests with the decision makers, those who wield the economic and administrative power to make the vital difference.
The development of new, cutting-edge designs and the products that derive from them, both tangible and intangible, is often subject to enormous market pressures that impose haste. This haste is obviously the antithesis of a well-structured design process that features iterative user consultation as one of its most important tenets since consultation necessarily calls for a certain amount of time if it is to generate meaningful results. Never was the proverb “more haste, less speed” more relevant than in cases of hasty project developments that lead to products with a merely marginal appeal: they may be fast to market, but they are often fated to exclude large swathes of their potential users, so will be consigned to the oblivion of obsolescence far earlier than would be the case if users had been involved.
Decision makers must also be alerted to the importance of the economic argument for user involvement. Without it, the potential market for a product (whether tangible or intangible, a service or a system) will necessarily be curtailed to the median percentiles of those who have no difficulty using it and those who are willing and able to make the necessary adaptation in their own habits and methods to take its poor, unfriendly design into account. All others will be excluded, together with the market revenue they bring with them. It is for this reason that decision makers must be included in the process of learning about inclusive design methodology.

In conclusion
It is the firm conviction of the LIVE IT Project that the value of its work lies not only in the immediately apparent results achievable in the short timeframe of the project’s life cycle, but also in how these can be employed as examples of scenarios lying outside the range of the percentiles

of the using public normally taken into consideration by designers, developers and decision makers in every design process (not only that of accessibility) and projected usefully onto the reality of a society, our society, in which the concept of mainstream is changing with staggering rapidity. It is in this respect that policy makers at the European Parliament can act to provide a legislative and financial framework that will enable this process to move forward at a sufficient rate to keep pace with this change.

9 CONCLUSION

In this report, we shared the results of Task 2.4, scenario validation, which are the set of LIVE IT Scenarios for All. Task 2.4 is situated within LIVE IT WP2, and it followed the implementation of scenarios developed in Task 2.2 (reported in Deliverable 2.2). Data were collected on the implementation of scenarios within each of the LIVE IT Co-Labs in order to validate the scenarios as viable tools for co-designing web accessibility solutions with PwCD. The results of this scenario validation are the final LIVE IT Scenarios for All, which are the set of initial, revised, and new scenarios within each Co-Lab that allowed for the exploration of web accessibility tools with PwCD.
In Chapter 1, we described the nature of this report and located it within the context of the LIVE IT Project as a whole. Generally speaking, Task 2.4 is the connector between the scenarios developed for Deliverable 2.2 using the baseline research conducted in WP 1 (reported in Deliverable 1.1 and Deliverable 1.2) LIVE IT Open Toolkit development and Hackathons in WP 3 and WP 4, respectively. In Chapter 2, we reviewed the initial scenarios from Deliverable 2.2. In Chapter 3, we presented the methods and results for the scenario validation undertaken in Task 2.4. Finally, in Chapter 4, we share the comprehensive set of validated Scenarios for All.

Recall that during scenario implementation, user feedback on tools was also collected. The results of the user feedback data collection are presented in The Final Evaluation Report. The results of Open Toolkit user feedback are presented in Deliverable 4.4. This report is a supplement to the user feedback results, because it provides a comprehensive look at the Co-Lab mechanisms for collecting the user feedback data: scenarios.

In conclusion, we hope that researchers will use the Scenarios for All (Chapter 4) as a foundation for ongoing web accessibility research with PwCD. The LIVE IT Scenarios are wide raging in terms of scope, focus, and tools used. However, they do not cover everything. We hope that researchers will see what we could not cover and fill those gaps. Additionally, we hope that researchers will see what we did cover and extend on this foundational work.

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