Raising Accessibility Awareness: Designing Accessibility Testbed for Education and Public Use

TERO AVELLAN*, Tampere University, Finland
PAULIINA BALTZAR, Tampere University, Finland
MARKUS KÄMÄRÄINEN, Tampere University, Finland
MARKKU TURUNEN, Tampere University, Finland

As accessibility's importance continues to grow, there is a need to develop accessibility education and raise awareness through engaging hands-on experiences. First, this article describes the design process of the public accessibility testbed, which includes points where visitors can observe and use assistive technologies and simulation tools to experience accessibility challenges. Second, we conducted a survey for visitors. Exploring the effectiveness and impact of accessibility points, we aim to assess how these points facilitate learning about accessibility issues, specifically whether visitors leave with a deeper understanding of these challenges. Also, we evaluated the guidance and information provided at these points to enhance visitor understanding and engagement. The findings also gather insights on potential improvements or new features for the accessibility points based on visitors' suggestions.

CCS Concepts: • **Human-centered computing → Accessibility design and evaluation methods**.

Additional Key Words and Phrases: accessibility awareness, assistive technology, disability simulation, testbed

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1 INTRODUCTION

According to the World Health Organization (WHO) [17], one in six people have a disability and typically experiences poorer health, lower educational attainment, fewer economic opportunities, and higher poverty rates compared to those without disabilities [16]. However, these are mainly due to the limited availability of services and the numerous daily obstacles that individuals with disabilities face [4, 16, 17]. The number of people with disabilities is assumed to rise significantly due to aging and wars.

The United Nations Convention on the Rights of Persons with Disabilities (CRPD) [13] requirements for improving accessibility have become part of legislation and policies worldwide. Overall, legislation's changing attitude towards disabilities and accessibility is seen in the growing interest in, for example, accessibility education [1], covering topics such as disability awareness and methods for producing accessible solutions. However, understanding disabilities can

*Corresponding author.

Authors' Contact Information: Tero Avellan, tero.avellan@tuni.fi, Tampere University, Tampere, Finland; Pauliina Baltzar, pauliina.baltzar@tuni.fi, Tampere University, Tampere, Finland; Markus Kämäräinen, markus.kamarainen@tuni.fi, Tampere University, Tampere, Finland; Markku Turunen, markku.turunen@tuni.fi, Tampere University, Tampere, Finland.

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be complex, even though everyone has experienced at least temporary (for example, an ear infection) or situational disabilities (for example, a noisy environment) [5, 10, 17]. WHO's ICF [15] defines a person's functioning and disability as a combination of health conditions and contextual factors, such as personal and environmental factors. As accessibility's importance is recognized, there is a need to develop education on accessibility and raise awareness through hands-on experiences.

First, this article describes the design process of the public accessibility testbed, which includes accessibility points demonstrating various practical accessibility solutions. At these points, the visitors can observe, experience, and try out different accessibility solutions, assistive devices, and equipment that simulate specific functional limitations or disabilities. The accessibility points are divided into three themes: *1) accessible workstation*, *2) accessible gaming*, and *3) observing accessibility*.

Second, we conducted an online survey for visitors to accessibility points, and to date, 11 responses have been collected and analyzed, with data collection ongoing. Exploring the effectiveness and impact of accessibility points, we aim to assess how these points facilitate learning about accessibility challenges and evaluate the guidance and information provided to enhance visitor understanding and engagement. The findings also gather insights on potential improvements or new features for the accessibility points based on visitors' suggestions.

2 DESIGNING ACCESSIBILITY POINTS

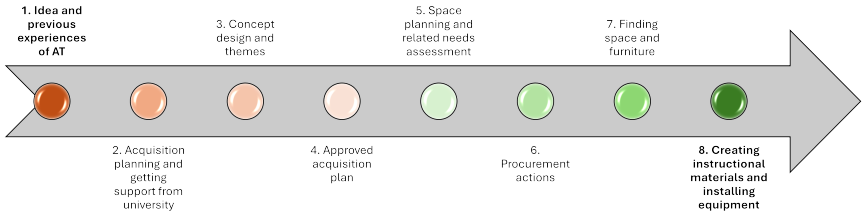

Fig. 1. The progress of the design and acquisition process.

The design process began in January 2023 (see Figure 1) with the ideation of a testbed where students and researchers could demonstrate assistive technologies and make observations. From the beginning, we had multiple goals, such as enhancing the visibility of accessibility knowledge, providing opportunities for everyone to try out devices, increasing awareness of assistive technologies, and developing an environment for teaching and research on accessibility. As the importance of this project was clear, we got funding for the project directly from Tampere University.

To acquire assistive technologies, we started with a needs assessment to identify specific requirements and stakeholders, conducted market research to evaluate potential suppliers and products, and developed a detailed budget, including all associated costs. Since accessibility solutions can range from a simple white cane to a more complex computerized system controlled by eye movements [3, 4], needs assessment is one thing to highlight. Human functioning and disability can encompass conditions related to vision, hearing, mobility, and cognition, often overlapping within these categories [14, 16], each requiring customized solutions. Therefore, assistive technologies are not typically available as off-the-shelf goods and can also cost more than consumer products due to low production volumes and the custom nature [4, 11].

Our aim was to acquire a diverse range of assistive technologies and equipment, ranging from consumer products to unique specialized products, for everyday digital and non-digital activities, encompassing home use, computer work, and gaming. As recognized, various consumer technologies also have assistive potential; for example, mobile devices

such as tablets and phones are packed with accessibility features (for example, screen reader, voice assistant, and display changes such as colors, contrast, text size, and magnifier), and are targeted at the general markets, offering a lower cost threshold and a favorable social return on investment [4]. Common mobile platforms, such as Google Android[1] and Apple iOS[2], also feature application marketplaces and provide convenient access to special applications sold separately, such as symbol- and picture-based augmentative and alternative communication (AAC) communicators Widgit Go[3] and Avaz[4].

Based on the acquisition plan and products, the accessibility points are divided into three themes:

(1) **Accessible workstation:** Allows to explore various solutions to facilitate smooth digital interaction and computer-based work for all individuals. Assistive tools available at the workstation include, for example, a braille display, various types of mice and keyboards, a screen reader, and a glare-free reading light.
(2) **Accessible gaming:** Allows to explore various assistive devices, consoles, and specialized technology to enable inclusive gaming. The station features different playable gaming consoles equipped with assistive controllers, such as Microsoft Xbox Adaptive Controller[5], Tobii Eye Tracker[6], and Logitech Adaptive Gaming Kit[7], that accommodate individuals with different needs and accessible board games.
(3) **Observing accessibility:** Allows to try out simulators and equipment that simulate different limitations. This equipment includes, for example, the AgeMan[8] aging suit that illustrates the physical deterioration associated with aging and a collection of eyeglasses that simulate various visual impairments.

After the acquisition planning, concept design, and themes, we planned the layout to get an idea of the needed space (see Figure 2), following universal design principles [12]. We initiated procurement actions when the acquisition plan was approved, including an active discussion between the authors and the university's procurement staff. The plan comprised over 100 products. Notably, many have a limited number of manufacturers, suppliers, or resellers worldwide. This is time-consuming from the buyers' point of view, and the time it takes for final delivery can be long.

Concurrent with the ongoing procurement actions, we focused on planning and identifying functional spaces. This involved ensuring a space of sufficient size for approach, reach, manipulation, and use of assistive technologies and other equipment. Related to themes of accessible workstations and gaming, the planned furniture selection included functionality, ergonomics, and durability to support comfortable and efficient use. However, these aspects were mainly reserved for future development. Initially, we also ideated a mobile and portable accessibility testbed, enabling some assistive technologies and other equipment to be easily transported to various venues, including public events such as fairs and exhibitions, conferences, and research locations.

Instead, we focused on establishing stationery accessibility points on the university's premises, recognizing accessibility considerations, such as the importance of automatic door openers, proximity to essential services like toilets, optimal lighting, and a controlled soundscape to enhance accessibility. Additionally, we recognized that the space and its use could be influenced by various external factors similar to the public display deployments [7], including the use of surrounding spaces with concurrent events, the routines, and tasks of the people using the building, but also vandalism. Therefore, as a practical note, activities such as equipment labeling with contact details and mapping

[1]https://play.google.com/
[2]https://www.apple.com/app-store/
[3]https://www.widgit.com/products/widgit-go/index.htm
[4]https://avazapp.com/
[5]https://www.xbox.com/en-US/accessories/controllers/xbox-adaptive-controller
[6]https://gaming.tobii.com/
[7]https://www.logitechg.com/en-us/products/gamepads/adaptive-gaming-kit-accessories.html
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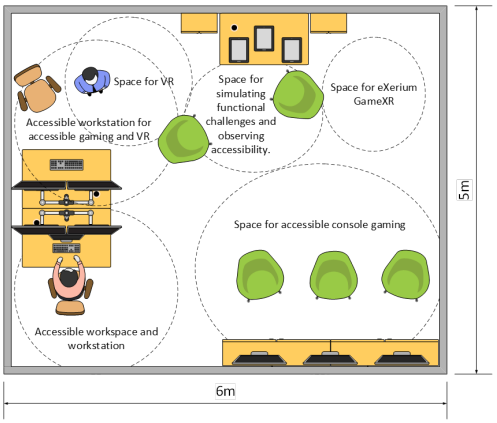


Fig. 2. First space plan in the planning phase.

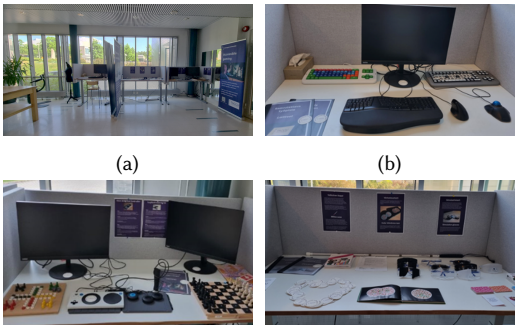


Fig. 3. The reserved physical space (a) is divided into three themes: accessible workstation (b), accessible gaming (c), and observing accessibility (d).

equipment mounting possibilities are essential, and there is a need for sufficient lockable storage in proximity to the space to keep the equipment secure and safe. These also affect accessibility and usability.

After identifying a suitable space, the final phase included creating instructional materials to communicate necessary information effectively to visitors. This phase also included the installation and setting of assistive technologies and other equipment, often requiring customized setups — however, physical setup and concerns related to durability and vandalism limited fulfillment. Therefore, the most affordable or rare assistive technologies and equipment, such as computers, are available only during guided tours. Despite these challenges, the accessibility points were established for the public audience in December 2023 at Tampere University's city centre campus (see Figure 3). The space is open during campus opening hours, and the points are freely available to the public.

3 DESIGNING SURVEY

Since establishing the accessibility points, several groups and individuals have visited, raising a need to gather information to support future development and explore potential research opportunities. As a method, we used a survey as a common way to collect experiences among a large sample of individuals [6, 9]. A web survey was designed in the spring of 2024 to collect experiences and feedback, including the research questions *how these points facilitate learning about accessibility challenges*, *how to enhance visitor understanding and engagement*, and *what insights there are on potential improvements or new features*.

The survey questions were designed through discussions among the authors, including multiple-choice and open-ended questions divided into the background, during, and after-visit categories. Microsoft Forms was used as a platform, and the survey was designed with accessibility in mind, such as enabling answering the questions with a screen reader. The first version of the survey was published in June 2024 and comprised a total of nine following questions:

(1) **Visit Type:** Participants identify whether they visited the points independently or as part of a guided tour.
(2) **Role in Accessibility:** Participants identify their role in the accessibility field, choosing from options such as working with accessibility, studying accessibility, researching accessibility, or not being involved.

(3) **Familiarity with Accessibility:** Participants rate their prior knowledge of accessibility, with options ranging from no previous knowledge, basic understanding, or good understanding with practical experience to extensive knowledge.
(4) **Learning and Integration:** Participants evaluated statements on a six-point scale from "disagree" to "agree," including a "no opinion" option. These statements assessed whether they learned new things, gained new ideas, or saw accessibility as an integral part of their work after visiting the points.
(5) **Usability of Points:** Participants evaluated statements on a six-point scale about the ease of finding the points, understanding how to use the devices, and the adequacy of available guidance.
(6) **Positive Aspects:** An open-ended question asking what aspects of the accessibility points worked well.
(7) **Areas for Improvement:** An open-ended question asking what could be improved.
(8) **Recommendation:** Participants were asked if they recommend visiting the accessibility points to others.
(9) **Additional Comments:** An open-ended question allows participants to provide additional comments.

4 SURVEY RESULTS

The survey was shared in June 2024 with individuals who had visited the accessibility points during the past year, and to date, we have received 11 responses (n=11). However, the survey and data collection will continue. The first part of the results delves into the participants' background information, providing context for the analysis. The second part examines their experiences during and after visits to the accessibility points. Insights from their feedback are highlighted to understand the overall effectiveness and areas for improvement, offering an understanding of the further development and enhancement of the accessibility points and the future accessibility testbed.

4.1 Background information

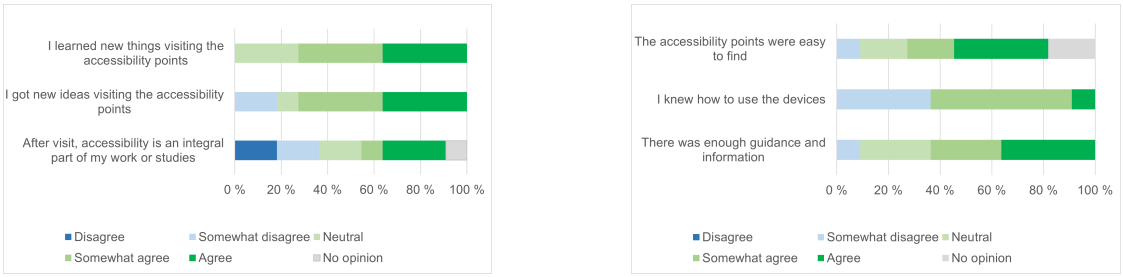
All the participants visited the points as part of a guided tour. Most (73%) worked with, researched, or studied accessibility-related topics. The remaining participants either did not work in the accessibility field or described themselves as teachers without specifying if they teach accessibility-related subjects. Most participants (82%) also described that their familiarity with accessibility is good, with some practical experience. The remaining considered themselves to have a basic understanding of accessibility concepts.

4.2 During and after visiting the points

Most participants (73%) somewhat agreed or agreed that they had learned new things by visiting the accessibility points, as shown in Figure 4a. Similarly, most participants (73%) somewhat agreed or agreed that they got new ideas from visiting the accessibility points. However, opinions were divided on whether accessibility would become an integral part of their work or studies after the visit, where 4 participants somewhat agreed or agreed with this statement. Another 4 participants somewhat disagreed or disagreed, and 3 participants had a neutral perspective or no opinion.

While visiting the points, most participants (55%) agreed or somewhat agreed that they were easy to find, as shown in Figure 4b. Likewise, most participants (64%) somewhat agreed or agreed that they knew how to use the devices at the accessibility points. Additionally, most (64%) agreed or somewhat agreed that enough guidance and information was available at the accessibility points.

In response to the open-ended question regarding what worked well, participants expressed appreciation for the opportunity to test the solutions personally. The simulation glasses were particularly well-received, and the introductions provided by the guides were also positively noted. "*It's always very different to be told about something and to experience*



(a) (b)

Fig. 4. (a) How participants described their visit. (b) Guidance and information experiencing the points.

it (to some extent) yourself" (P10). Further, participants suggested enhancing the visibility of the points through color coding. Also, a larger space was mentioned, where each table could showcase a single theme or equipment. Additionally, the idea of scheduling pre-announced demonstration hours was proposed.

Furthermore, participants expressed a need for a clearer connection between the different sections, elements, and tasks that could be performed while using the equipment. "*There were lot of different things scattered on top of two basic working desks. Maybe next time the center could be larger and have more points - for example one theme / gadget etc per point? In this way it would be even easier to spot the right guidance text / further information about each theme / gadget*" (P9). One participant mentioned, "*Not sure how to put it in words, but kind of a story or smoother linking between the sections or elements. It felt a bit like a bunch of separate things put on the tables next to each other. Obviously there is the common denominator of accessibility, but something was missing still. Oh and maybe add some examples of tasks, for example next to the glasses to read or draw a circle while having the "tunnel vision" glasses on.*" (P10). Lastly, most participants (73%) agreed they would recommend visiting the accessibility points to others. In contrast, two participants mentioned that they might recommend it, and one stated they would not.

5 CONCLUSION AND FUTURE WORK

The accessibility points are established to raise public accessibility awareness while supporting accessibility education and research on the university's campus. Visitors can try out assistive technologies and experience disability simulation tools to gain an understanding of accessibility challenges. However, despite the public interest and generally good feedback, we have recognized *the need for active marketing and consistent feedback collection to enhance and refine the visitor experience.*

Notably, to date, all survey participants have visited the points as part of a guided group, with the survey constrained by a limited number of responses. Hence, *future research should prioritize individuals* who visit the points independently and utilize more qualitative methods. As lessons learned from the design process and the survey data, we identified a few essential tasks for future work.

The survey data highlighted accessibility and usability aspects, with recommendations to include better guidance and information, such as providing clear and accessible instructions for using the equipment. This is partly related to the space design but also emphasizes *the importance of testing and evaluating accessibility through the process.* Also, in this case, we should especially consider individuals who visit the points.

As a lesson learned, *it is also essential to identify the need to acquire assistive technologies and other equipment.* This can be achieved by utilizing personas, identifying specific requirements, and consulting stakeholders to evaluate potential suppliers and products. Additionally, consumer digital technologies have significant assistive potential, and exploring trends, benefits, and customization options is essential for future work.

Also, when planning future accessibility testbeds, it is essential to consider learning aspects and provide examples. The survey participants mentioned gaining new insights and gathering fresh ideas during the visits. Suggestions included more thematic separation and the addition of interactive tasks to enhance engagement. The literature highlights [2, 8] creative activities like designing, personalizing, sharing, and reflecting that are particularly valuable when learners actively construct knowledge.

Overall, we hope this work influences the design of similar setups to raise accessibility awareness and encourage hands-on experiences. Based on the ideation and the feedback, we also see the potential for *designing mobile and portable accessibility testbeds, with related interactive digital elements and virtual environments* as a future direction.

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