Electronics and Employability Advancement for Adults with Down Syndrome

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WP3.1 NATIONAL DESK RESEARCH

This report lays the foundation for developing the training format and digital tools through conducting national-level research with 1) Key information about the educational needs of adults with Down Syndrome in technology-related learning; and 2) Best practice examples of existing methodologies, tools or materials already used to educate adults with intellectual disabilities (especially in electronics, coding, tinkering or general digital training).

Country: GERMANY

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Introduction

This national report presents the results of research conducted in Germany to support the development of Work Package 3 (WP3) of the FEAT-DS project – "Electronics and Employability Advancement for Adults with Down Syndrome". The overall goal of WP3 is to co-design inclusive, accessible, and engaging training formats in the field of basic electronics and digital skills for adults with Down Syndrome (DS). In order to ensure that the training is rooted in real needs and good practices, each partner conducted national-level research to understand the educational needs, existing tools, inclusive learning strategies, and policy environment relevant to adult learners with DS.

This report aims to:

- Identify cognitive, social, and communication barriers adults with DS face in learning, particularly in technical contexts such as electronics or coding.
- Review learning preferences and accessibility requirements, drawing from national practice and international research.
- Collect and analyze best practices in inclusive technology education used in Germany.
- Extract key insights to inform the co-design of WP3 training modules.
- Map existing policy frameworks and institutional roles related to adult education, digital inclusion, and disability support.

1. Educational Needs Overview

Adults with Down Syndrome (DS) in Germany face a complex set of barriers that limit their access to formal education and vocational training, particularly in the fields of technology, electronics, and digital skills. These barriers can be broadly categorized into cognitive, communicative, social, and systemic challenges.

From a cognitive perspective, individuals with DS typically experience mild to moderate intellectual disabilities that affect memory, processing speed, attention, and abstract reasoning abilities. Short-term memory limitations can make it difficult to retain multi-step instructions, while challenges with abstract thinking impact the understanding of theoretical concepts common in technical subjects such as electronics or programming. This creates a need for learning formats that minimize cognitive overload by breaking down complex tasks into smaller, manageable steps and providing consistent repetition to reinforce learning.

Communication barriers compound these difficulties. Many adults with DS have delays or impairments in both receptive (understanding) and expressive (speaking or writing) language skills. This can make comprehension of conventional instructional materials — which often rely on complex language and technical jargon — particularly challenging. In response, the use of **Leichte Sprache** (easy-to-read German), which employs simple vocabulary, short sentences, and visual aids, has been recognized as essential to improving accessibility. In addition, non-verbal cues, symbols, pictograms, and demonstrations become critical tools for enabling understanding and engagement in learning activities.

Social factors also present significant hurdles. Despite progress in inclusive education policies, adults with DS often face social exclusion in adult life. After leaving the formal school system, many transition into sheltered workshops (*Werkstätten für behinderte Menschen*) or supported living environments where opportunities for further learning, especially in digital or technical domains, are limited or nonexistent. This isolation reduces motivation and access to meaningful, skill-building experiences necessary for employment and independence.

Regarding learning preferences, adults with DS tend to thrive in environments that emphasize **hands-on, experiential learning**, and **visual supports**. Learning activities that involve direct interaction with objects or technology, such as manipulating electronic components or programming using tangible interfaces, are more effective than abstract, text-based instruction. Additionally, structured routines and repetition help to consolidate knowledge and build confidence. Sensory feedback, like lights, sounds, or vibrations, supports learners in understanding the consequences of their actions and maintaining attention.

In Germany, some institutions and organizations have started to develop adapted digital learning experiences tailored to the needs of people with intellectual disabilities. For example, **Volkshochschulen (VHS)**, which are public adult education centers, occasionally offer courses aimed at basic digital literacy or computer skills with modifications for diverse learners. Non-profit organizations such as **Lebenshilfe** and **Caritas** also play a role in providing workshops and supported training programs that incorporate accessible technology and pedagogical approaches designed for individuals with cognitive impairments.

However, these initiatives tend to be **isolated and inconsistent** across regions. A national-level systemic approach to inclusive digital education for adults with DS and similar groups remains lacking. This is reflected in several ongoing challenges:

- **Lack of specialized curricula:** Most adult education programs do not have tailored materials specifically designed for learners with intellectual disabilities in technology fields. Existing curricula often assume a baseline level of literacy and cognitive ability that excludes many adults with DS.
- **Insufficient training for educators:** Many trainers and educators in adult learning centers and social care institutions have limited experience or formal training in differentiated instruction methods that accommodate the learning needs of people with DS. This gap reduces the quality and effectiveness of the support provided.
- **Minimal integration of digital inclusion policies:** While Germany has adopted broad strategies for inclusive education and digital literacy, such as the **National Action Plan 2.0** for implementing the UN Convention on the Rights of Persons with Disabilities (UN CRPD),

these policies have not yet translated into widespread, systematic support for adults with intellectual disabilities in the realm of technology education.

- **Fragmented responsibility and coordination:** Education, social care, and employment services are governed by different agencies at the federal, state (*Bundesland*), and municipal levels. This fragmentation complicates the establishment of cohesive programs that combine digital skills training with social and vocational support tailored to adults with DS.
- **Limited funding and resources:** Programs that do target inclusive digital education often rely on temporary project funding or pilot initiatives, making it difficult to sustain or scale up effective interventions.

In spite of these barriers, Germany's commitment to inclusion and disability rights provides a promising foundation. The emphasis on **accessible language (Leichte Sprache)**, **community education through VHS**, and the involvement of strong civil society organizations like Lebenshilfe create opportunities for developing and expanding technology-focused training that meets the needs of adults with DS.

Moving forward, there is a clear need to create training formats that are not only **cognitively accessible** but also **socially supportive** and **systemically integrated**. Such programs should incorporate multi-sensory, hands-on learning with clear visual supports and provide ongoing educator training. They should also foster partnerships among adult education providers, social care institutions, and disability organizations to coordinate resources and share best practices.

2. Best Practice Examples

2.1. Calliope mini – Educational Microcontroller Kit

One of the most effective educational tools used in Germany to support adults with intellectual disabilities, including Down Syndrome, is the **Calliope mini**. This microcontroller kit enables learners to explore basic programming through a visual, block-based interface such as Open Roberta or MakeCode. The design incorporates color-coded blocks, large tactile buttons, LEDs, and sensors, allowing users to see and hear immediate feedback from their programming efforts. The hands-on, sensory-rich nature of Calliope mini makes it particularly suited to the learning preferences of adults with Down Syndrome, who benefit from concrete, visual, and interactive activities. This tool has been successfully integrated into inclusive workshops and adult education settings, demonstrating increased engagement and understanding among mixed-ability groups. Calliope mini's ability to connect electronic tinkering with simple coding tasks aligns closely with the FEAT-DS project's goals to develop accessible and engaging electronics training.

Contact: https://calliope.cc/

2.2. IncluKIT – Inclusive STEM Training Kit

Another relevant tool is **IncluKIT**, an inclusive STEM training kit designed to introduce fundamental concepts of electricity and circuits in an accessible way. IncluKIT uses tactile components that are color-coded and accompanied by step-by-step task cards written in plain language with symbols, making the learning process approachable for individuals with intellectual disabilities who may have limited reading skills. Through hands-on activities such as connecting circuits, activating switches, and experimenting with sensors, learners develop not only technical skills but also fine motor coordination and logical sequencing abilities. This kit has been piloted by organizations like Lebenshilfe and Aktion Mensch, with positive feedback indicating improved task completion and learner confidence. IncluKIT's structured yet flexible approach to electronics education makes it a valuable resource for the FEAT-DS training modules aimed at adults with Down Syndrome.

Contact: https://www.inklusion-digital.de/inclukit

2.3. Mebis barrierefrei – Accessible Learning Platform

Lastly, the **Mebis barrierefrei** platform exemplifies an accessible digital learning environment developed by the Bavarian Ministry of Education. Although not exclusively targeted at people with Down Syndrome, Mebis barrierefrei incorporates multiple accessibility features such as symbol-supported navigation, easy-to-read language (Leichte Sprache), subtitles, audio descriptions, and screen reader compatibility. These features enable learners with cognitive and sensory impairments to engage with online content independently and confidently. The platform has been piloted in inclusive schools and adapted for adult vocational learners, demonstrating its versatility as a model for delivering accessible digital training. Its design principles offer valuable insights for FEAT-DS in developing a user-friendly digital or blended learning format that accommodates the diverse needs of adults with Down Syndrome.

Contact: https://www.mebis.bayern.de/infoportal/barrierefrei/

3. Insights for WP3 Co-Design

The national research in Germany highlighted a combination of cognitive, communicative, and systemic barriers that adults with Down Syndrome face when accessing digital and technical education. The insights below draw directly from these challenges and reflect the practical adaptations that have proven successful in Germany.

3.1. Focus on step-by-step, practical learning: People with Down Syndrome often face difficulties with memory, attention, and abstract thinking. For this reason, the training format should focus on small, manageable tasks, delivered in clear sequences. Hands-on learning is particularly effective. Learners should interact directly with physical tools, such as simple electronic components, buttons, or sensors, so that they can see and understand the result of their actions. Repetition and routine are also key to reinforcing what they've learned.

3.2. Use visual communication wherever possible: Written instructions alone are not enough. The use of images, symbols, color coding, and demonstrations is essential. These elements help learners follow instructions, remember steps, and stay oriented. Materials like IncluKIT and Calliope mini have been successful because they combine tactile elements with clear visual guidance. Our training should include diagrams, pictograms, and photos alongside every task. This should be consistent across modules to avoid confusion.

3.3. Use easy-to-understand language: Instructions should be short, simple, and positive. Leichte Sprache (Easy Language) is important, and learners benefit from hearing direct, friendly messages like "Press the button" or "Try again." Long or technical explanations should be avoided. Instead of describing theory, it's better to show the learner what to do through action and example.

3.4. Choose tools that give instant feedback: Learners are more engaged when they can see or hear the result of what they do. Tools that use lights, sounds, or movement help them stay motivated and understand whether they completed a task correctly. This also supports memory and attention. For example, when a circuit works and a light turns on, it helps the learner connect cause and effect without needing abstract explanation.

3.5. Keep interfaces and tasks simple and clear: Training platforms must be easy to navigate. Overcomplicated screens with many buttons, scrolling, or pop-ups should be avoided. Each screen or task should have one main goal. A clean and predictable layout will reduce stress and help learners focus. This also applies to physical worksheets or task cards — they should be uncluttered, with large fonts and clear icons.

3.6. Support the educators: In Germany, many adult educators and trainers have little experience teaching people with intellectual disabilities. To make the training work, we must provide clear guidance and ready-to-use tools for instructors. That includes step-by-step instructions, visual aids, and suggested ways to adapt activities. Educators should be encouraged to use flexible methods and focus on creating a positive, supportive learning environment.

These insights show that training in electronics and digital skills is possible — and meaningful — for adults with Down Syndrome. But it needs to be designed with their learning needs in mind: hands-on, visual, simple, and supportive. By using the right tools and working together across institutions, we can create real opportunities for inclusion.

References and Links

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