Co-Design of Technology with and for People with Intellectual Disabilities: A Scoping Review of Methods and Inclusion Strategies

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Abstract

People with Intellectual Disabilities (ID) remain underrepresented in the co-design of technology, despite a growing emphasis on inclusive design within HCI. This scoping review synthesises knowledge on co-design methods by examining how people with ID and their support networks have been involved in technology design. A systematic search of four databases identified 25 relevant papers. Our analysis draws together the design methods and inclusion strategies used across these studies, highlighting practices, tools, and adaptations that accommodated diverse abilities, built trust, and supported agency. From this synthesis, we articulate how co-design practices have been tailored to promote inclusivity and propose principles and approaches to guide future research that centres ID perspectives. These findings provide researchers, designers, and practitioners with insights for fostering the equitable participation of people with ID in the design of technology.

CCS Concepts

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

Keywords

Accessibility, Intellectual Disability, Co-Design

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1 Introduction

Co-design in the field of Human-Computer Interaction (HCI) refers to a collaborative design process that involves multiple stakeholders, including end-users, in the co-creation of design solutions [82]. In accessibility research, co-design has gained traction as it bridges the gap between research and lived experience, shaping technologies and services that are meaningful, relevant, and socially inclusive [7, 11]. However, opportunities for people with Intellectual Disabilities to participate in technology co-design processes remain limited. **Intellectual disabilities (ID)** and Intellectual Developmental Disorders (IDD) are synonymous, defined as neurodevelopmental disorders that begin in childhood and are characterised by significant limitations both in intellectual functioning and adaptive behaviour as expressed in conceptual, social, and practical skills [6]. Examples of ID include Down syndrome, Fragile X syndrome or Williams syndrome [44].

People with ID are often excluded from co-design due to cognitive, communication, financial, and attitudinal barriers [4, 31, 48, 65]. IDs vary widely among individuals, are mediated by the environment, and span a broad range of cognitive skills, which makes them particularly challenging to recognise and accommodate in design processes [9]. This has traditionally resulted in people with ID remaining underserved by technology, and underrepresented in HCI research design processes.

However, recent work highlights growing momentum around inclusive design practices and the need to involve people with ID in shaping technologies that affect their lives [37, 61, 93]. Existing review literature has predominantly focused on participatory inclusion strategies for autistic adults [60], children [49], tools and techniques for ASD-oriented research [75], and lived autistic experiences [61]. However, although both ID and Autism Spectrum Disorder (ASD) are neurodevelopmental conditions, they are distinct diagnoses with different manifestations, and findings from

ASD-focused research are not necessarily applicable to people with ID [6, 71, 97, 100]. Relevant to our work, the experiences of people with ID have been examined in Börjesson et. al's systematic review of designing technology for and with developmentally diverse children [13], Di Lorito et. al's review of co-research with people with ID [28], and Robb et. al's narrative review of participatory technology design for people with autism and other neurodevelopmental disabilities [77]. While these reviews centred on participatory design or co-research more broadly, our review offers a method-focused account of co-design inclusion. We propose that our review will be valuable for both emerging and established researchers seeking to understand the co-design methods used with people with ID and the ways these methods have been adapted to support inclusive participation. Collectively, these reviews outline the research landscape but also highlight the gap in understanding on how people with ID have been involved in technology co-design.

Our review, guided by the PRISMA-ScR framework, included peer-reviewed papers published across 4 databases, focusing on designing technology with people with ID. We identified key design methods, participation practices, and ethical considerations that inform future inclusive co-design work.

This scoping review offers three key contributions:

(1) A synthesis of the design methods and technologies used in co-design with people with ID.
(2) Analysis of how co-design methods have been utilised and adapted to support the inclusive participation of people with ID.
(3) Development of evidence-based principles and approaches for future co-design research that centre the agency of people with ID.

Our goal is to support more intentional, sustained, and inclusive collaborations with people with ID in HCI and related disciplines, to ensure that research not only advances technological innovation but also enhances social inclusion for this underserved population.

2 Background

2.1 Defining Co-Design within the Context of HCI

The concept of co-design is rooted in Participatory Design (PD). PD emerged from Scandinavia in the 1970s as part of workplace democracy movements seeking to empower workers by giving them influence over the technologies shaping their jobs [30, 82]. Modern interpretations of PD emphasise collaboration, where people with lived experience collaborate with diverse stakeholders to share design decision making power to shape project outcomes [19]. While traditions of Human-Centred Design (HCD) and User-Centred Design (UCD) have focused on designing 'for' users by prioritising usability, efficiency, and satisfaction [64], PD emphasises designing 'with' users, positioning end-users as collaborators with agency and influence over design outcomes.

Co-design is a process of collaborative creativity that spans all stages of design, bringing together people with lived experience, designers, and technical experts in iterative cycles of ideation, prototyping, and evaluation to develop solutions [82]. Central to co-design is the sharing of decision-making power, where each party contributes distinct expertise that enriches the perspectives of the others [18]. Co-design methods have become increasingly common across HCI and computing disciplines, reflecting a shift toward participatory and stakeholder-centred design approaches [51, 78]. Within HCI, the term co-design has been used interchangeably with related concepts such as *cooperative design*, which reflects its Scandinavian participatory design roots of consultation and cooperation, and *collaborative design*, which highlights more recent practices of joint enactment and creative engagement.

While PD and co-design are often used interchangeably in HCI [108], PD specifically requires the direct stakeholders from an organisation to act as co-decision makers in a democratically oriented process that redistributes power and centres long-term, situated, mutual learning. Co-design, by contrast, supports participation in similar procedural ways but places stronger emphasis on users shaping the design agenda itself [91] and enables broader, more flexible collaboration between designers and non-designers in contexts where existing power structures may remain intact [108].

As a methodology, co-design is distinguished not by the individual techniques it employs, but by the way these techniques are used to inform design *with* co-designers rather than simply collecting feedback *from* participants. For instance, while low-fidelity prototyping is often used in UCD to elicit feedback from end-users on a designer's idea, in co-design it becomes a tool for exploration, ideation, negotiation, and decision-making in collaboration with users [67]. Co-design methods such as workshops, prototyping, role-play, storytelling, cultural probes, and make-tools often draw on creative, visual, and tangible modalities to support playful storytelling, reflective expression, and the communication of tacit or latent knowledge [75, 77, 82].

The adoption of co-design in HCI reflects a recognition that user participation is essential not only for creating technologies that are more usable and meaningful but also for affirming individuals' rights to influence the technologies that shape their lives [18]. This participatory shift has been especially important for communities historically excluded from mainstream technology design, as designers often don't have lived experience of the disabilities they're designing for, therefore making co-design vital in this space. HCI has increasingly adopted co-design approaches with people with disabilities across physical, sensory, cognitive, and neurodevelopmental contexts, including the development of accessible input devices for physical disabilities [88], communication tools and inclusive learning environments for deaf children and youth [53], and tactile graphics, navigation aids, and educational technologies for individuals with vision impairment [1].

A growing body of co-design research has concentrated on neurodevelopmental disabilities, particularly in relation to autistic individuals, where a substantial body of co-design research has been motivated by distinct social and communication profiles. Robb et al.'s (2021) review highlight methods such as visual supports, tangible prototyping, and role-play, which help autistic participants overcome communication challenges to articulate their preferences and contribute creatively [77]. Ravn et al.'s 2022 review of applied co-design tools and techniques with ASD adults found that interviews and observations were the most frequently used methods [75]. The review further noted that, although these approaches might not be considered co-design in a strict sense, they are often incorporated into broader design processes involving people with ASD. A key critique of ASD-focused co-design research is that autistic participants are often involved only in evaluation phases, which limits their opportunities for meaningful contribution and reinforces deficit-oriented framings [38]. More inclusive approaches, by contrast, seek to position autistic participants as co-creators and experts [49].

Despite growing interest, people with ID remain significantly underrepresented in co-design compared to other groups. Where they have been included, research stresses the importance of flexible, multimodal communication supports (e.g., Augmentative and Alternative Communication (AAC), Easy Read materials) and structured yet adaptable sessions [21, 36]. This aligns with calls for inclusive HCI research to expand beyond ASD-dominant populations and to recognise the diversity of lived experiences within ID populations [38, 54].

2.2 People with ID

Intellectual Disability (ID; or Intellectual Developmental Disorder, IDD) is defined as a neurodevelopmental disorder characterised by significant limitations in both intellectual functioning and adaptive behaviour, which forms the collection of cognitive, conceptual, social, and practical skills that people develop to live independently and interact with others [6]. These factors lead to difficulties in communication, social interaction, learning, independent living, and participation in daily activities [29]. ID can have many causes, including genetic conditions such as Down syndrome or Williams syndrome, exposure to harmful substances during pregnancy, complications at birth, and brain injuries that occur early in life [98]. Unlike acquired brain injury (ABI), which occurs after a period of normal development, ID emerges during the developmental period and is therefore considered a distinct diagnosis [43]; this review is scoped to focus exclusively on ID. Severity is classified as mild, moderate, severe, or profound, based on functional abilities rather than IQ score alone [68]. The level of support required therefore varies; individuals with mild ID may only need occasional assistance with complex abstract tasks, while those with profound ID often require continuous, intensive support across all aspects of daily living [70]. Increasingly, support needs are being used as an emerging metric of assessment across domains such as communication, social interaction, and daily living, recognising that support levels (low, medium, high) often provide more actionable information for planning and intervention [85]. The number of people with ID is significant, with estimates suggesting that approximately 1% of the population have the condition [98].

Although disability-focused research has gained prominence since the 1990s [68], people with ID remain underrepresented in HCI research. Colley et. al's (2022) meta-analysis on accessibility research demonstrated a predominant focus on blindness and low vision, which accounted for approximately 43% of papers, compared to only around 12% focusing on d/Deaf and hard of hearing communities, 12% on motor or physical impairments, and 7% on cognitive or learning disabilities [25]. Given the dominance of research with autistic and Attention-Deficit/Hyperactivity Disorder (ADHD) populations within the broader neurodevelopmental literature, it is likely that ID accounts for an even smaller proportion of this cognitive/learning disability figure [29]. Broadly, accessibility research has tended to centre on sensory and motor impairments, developing tools to support screen reader use, alternative input devices, and inclusive interface design [25]. These studies have undoubtedly advanced digital inclusion, but they also reflect a concentration of effort that leaves other groups comparatively overlooked.

Within the limited neurodevelopmental disorders focused HCI literature, research has predominately focused on ASD, particularly in developing assistive technologies to support communication, social skills, and learning [56]. ID commonly co-occurs with other neurodevelopmental disorders such as ASD, which may involve differences in social communication and restricted or repetitive behaviours; ADHD, characterised by inattention, hyperactivity, and impulsivity; and specific learning disorders, such as dyslexia (difficulties with reading) or dyscalculia (difficulties with mathematics) [29]. While all presenting as neurodevelopmental disorders, these conditions and diagnoses are distinct and stand apart from ID [6]. For this scoping review, papers were only eligible for inclusion where co-designers were explicitly described as having an ID, with or without co-occurring conditions, or where caregivers and specialists of people with ID were involved.

Barriers to include people with ID in research include persistent societal perceptions that individuals with ID lack the cognitive capacity to engage meaningfully in research, alongside logistical and ethical complexities around recruitment and consent, as well as challenges in adapting standard methods [87]. IDs vary widely among individuals, are mediated by the environment, and span a broad range of cognitive skills, which makes them particularly challenging to recognise and accommodate in design processes [9].

Researchers have argued for more inclusive research that meaningfully involves individuals with ID across the full spectrum of ability levels in the design and evaluation of technology [54, 68]. Participatory research approaches, where participants are collaborators with influence over process and outcomes, offer an empowering opportunity for people with ID to meaningfully contribute to research while enhancing the relevancy of outputs [98]. While a recent scoping review of participatory design with autistic adults has provided valuable insights into how involvement has been enabled across studies, it offered limited discussion of the methodological approaches underpinning this work [61]. The present review turns its attention to co-design with people with ID, with a specific focus on examining methodological practices of co-design and offering adaptation strategies. Greater understanding of methodological approaches and inclusion strategies for people with ID in HCI research will be essential to increase representation and address the systemic inequities that currently limit participation [54, 68].

3 Methodology

In this section, we provide an account of our search strategy and data sources, the process for eligibility screening, the inclusion and exclusion criteria, and our approach to data extraction and analysis. The findings are reported in accordance with the

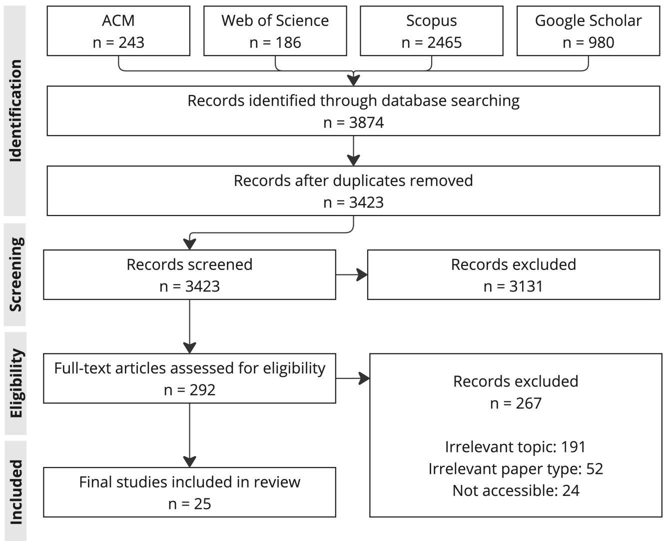

Figure 1: PRISMA-ScR flowchart of study selection process

Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist [99]. Although PRISMA-ScR was originally developed within health sciences, its structured reporting framework is increasingly applied in HCI and design research [80, 94]. It supports transparent reporting of search strategies, screening, and study selection across diverse literature [84], which is particularly important in interdisciplinary co-design research, where HCI often intersects with healthcare, rehabilitation, and accessibility domains.

The review process is summarised in the PRISMA flow diagram (Figure 1), which provides a graphical representation of the number of papers identified during the search and the progression through each review phase. The diagram details the number of papers retained after the title and abstract screening and the full-text review, indicating the reasons for exclusion at the full-text stage.

3.1 Search Query & Selection

Search Criteria	Search Terms
Intellectual & Developmental Disability Related	"intellectual disabilit*" OR "cognitive disabilit*" OR "developmental disabilit*" OR "neurodevelopmental disorder" OR "intellectual impairment" OR "cognitive impairment" OR "developmental impairment" OR "neurodevelopmental impairment"
Co-Design Related	"co-design" OR "co design" OR "participatory design" OR "co-making" OR "co-research" OR "cooperative design" OR "collaborative design"

Table 1: Search Terms Used in the Scoping Review

We conducted the literature search using the keywords listed in Table 1 across four digital databases, namely, Association for Computing Machinery (ACM), Scopus, Web of Science, and Google Scholar. The search included all studies published until January 2025, with no restrictions on the publication year. The generation of keywords for our search involved careful discussion between the authors and, as we reviewed the literature, the list of search terms were continuously refined to ensure a comprehensive coverage.

We included a range of population-related search terms for ID as well as subsequent wildcards. This strategy sought to acknowledge the historical and cultural differences in how ID is described, ensuring that relevant studies were not missed due to terminological variation. However, terms specifically referencing ASD were excluded, as ASD represents a distinct diagnosis to ID. To capture methodological diversity, we incorporated design-related terms describing co-design approaches commonly used in HCI and design research. Consistent with Maye & Hansen's (2024) review, no technology-specific keywords were applied to avoid limiting the scope of included studies [61].

An initial search was conducted in the first quarter of 2024 which yielded 2,425 records. A follow-up search was conducted in the first quarter in 2025 to capture more recent publications, identifying an additional 1,449 records. In total, the keyword search yielded 3,874 articles, with 243 from ACM Library, 186 from Web of Science, 2465 from Scopus, and 980 from Google Scholar. After removing 451 duplicate entries, 3,423 articles remained for title and abstract screening. The inclusion criteria were as follows:

- **Publication criteria:** Full-length peer-reviewed research papers, with no restrictions on publication date. Studies published in non-full-paper formats (e.g., workshops, posters, extended abstracts, theses, book chapters, works in progress, newsletters) were excluded.
- **People with ID focused:** The study involved people with ID, caregivers or proxies to people with ID, and/or field academics or specialists in ID.
- **Technology focused:** The study explored the usage, creation, adaptation, role, or influence of technology.
- **Co-design focused:** The study explicitly identified its methods and/or methodology as co-design. Studies describing participatory research or co-research that did not identify as co-design were excluded.
- **Study Qualities:** The study reported a co-design project with sufficient detail of the study design and activities. Papers offering a theoretical perspective, a proposal for future work, or a reflective interpretation of prior work were excluded.

Two authors independently conducted the screening process. Any discrepancies were reviewed and resolved through weekly discussions with the entire research team. We applied the aforementioned inclusion criteria to include peer-reviewed journals and conference papers written in English that focused on the use of co-design methods when designing technology with or for people with ID. When eligibility was unclear, we reviewed the full text. After title and abstract screening to remove false positives and irrelevant articles, 292 studies progressed to full text review. Studies were included only if they provided sufficient detail on co-designers, co-design methods, and their technology focus.

During the full-text review, 72 papers were excluded as they did not focus on technology, instead addressing medical and therapeutic interventions, policy development, educational curriculum, and various recreation-focused initiatives such as tourism, music, and play. Twenty-three papers were excluded as their research population was not ID-specific. Papers related to ID, ASD, neurodevelopmental disorders, Down syndrome, Williams syndrome, learning disabilities, mental illness, aphasia, dementia, and cognitive disabilities were captured by the search terms. However, only papers specifically mentioning intellectual and developmental disorders, Down syndrome and Williams syndrome were considered for title and abstract screening, as these conditions fall within the range of ID [6]. In addition, ID often co-occurs with developmental, motor, physical, linguistic, emotional, and sensory functions. Our review only included studies where these conditions were explicitly present alongside ID, ensuring a focused analysis of this population. Ninety-six papers were excluded because they did not identify as, or reference, co-design, instead framing their approach through PD, UCD, HCD or universal design. Although PD was included in the search terms to account for its occasional synonymous use with co-design in HCI, our work aligns with Yu (2025) in distinguishing PD and co-design as related but conceptually distinct approaches [108]. Accordingly, we included only studies that positioned co-design as their primary approach and may have referenced PD, but not studies that focused on PD alone.

While we recognise that many valuable contributions exist across a wide range of paper types and focal areas, we required sufficient process detail, clear relevance to the defined scope of co-design with people with ID and accessible full texts in order to achieve our method-focused synthesis. This yielded a total of 25 articles being identified as eligible for review (see Appendix, Table 6).

4 Overview of the Corpus

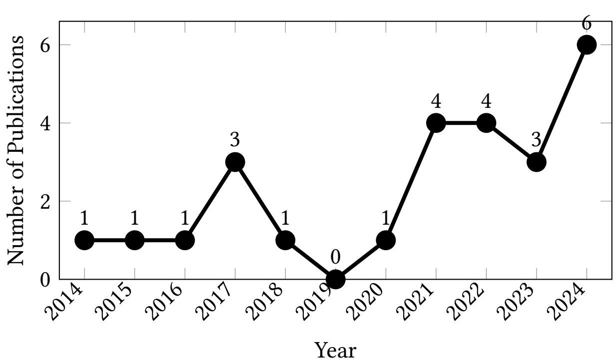

Figure 2: Distribution of reviewed studies by publication year.

Our analysis shows an upward trend in publications (see Figure 2), starting with the first in 2014 and accelerating from 2020, with most outputs (68%) appearing in conference venues. The trend reflects increasing momentum in the field, especially in the past five years, with HCI and accessibility venues serving as the main forums for dissemination.

For the high-level analysis of the 25 articles, we developed a classification taxonomy capturing research design and the application of co-design for and with individuals with ID. This taxonomy was inductively derived from the review corpus by identifying the fundamental, broadly applicable dimensions represented across co-design papers involving people with ID. Through iterative refinement, we established a set of classification categories including each article's focus, aim and contributions. Given the diversity of studies, articles were not restricted to a single category and could be assigned multiple classifications to reflect the composite nature of a study. For example, following discussion among the authors, it was agreed that Cibrian et al.'s (2017) paper offered both an artifact-based contribution, through the prototype of an elastic multisensory surface called BendableSound, and an empirical contribution, by providing evidence to demonstrate the efficacy of elastic multisensory surfaces to engage children with ID [22].

The focus of the co-design studies were categorised as technology, method or experience focused (see Appendix, Table 6). Of the 25 articles, near half (44%; n=11; [8, 20, 22, 45, 50, 63, 66, 69, 81, 92, 103]) were classified as technology-focused. We define technology-focused studies as those that explore or evaluate the design and development of technology systems or artefacts. This includes software-based applications (e.g., virtual reality environments, mobile apps) and hardware-oriented solutions (e.g., assistive devices, robots) that are co-designed with or for users. Studies were also categorised as being co-design method-focused (n=8; [9, 15, 26, 35, 41, 58, 74, 106]). This includes research that explores best practices, modifications to existing methods, or the development of new methodologies to facilitate inclusive co-design. Studies were also identified as being user experience focused (n=6; [2, 5, 72, 79, 83, 107]), where researchers sought to understand the lived experience of co-designers or the experience enabled by the co-designed solution. This category includes research that examines user engagement, accessibility, and the overall impact of co-design on individuals and communities.

Among the technology-focused studies, the most common were those involving custom software solutions (such as digital applications) (n=6; [50, 63, 66, 69, 81, 92]), followed by custom hardware devices (such as robots or wearable devices) (n=2; [8, 22]), mixed reality (such as virtual and augmented reality) (n=2; [45, 103]), and a conversational agent (n=1; [20]). Of the 8 method-focused papers, most explored the application of co-design methods (n=5; [26, 35, 58, 74, 106]), while the remaining method studies contributed novel or adaptive approaches to co-design (n=3; [9, 15, 41]). Most user experience–oriented studies examined user engagement (n=4; [2, 72, 83, 107]), while 2 papers explored the experiences of people with ID participating in the co-design process [5, 79].

Of the four primary aims of the corpus (Table 2), studies were predominantly exploratory, seeking to address gaps or generate new knowledge about inclusive co-design (n=12; [5, 8, 9, 15, 26, 35, 41, 72, 74, 79, 106, 107]). Intervention-oriented studies developed solutions to improve the lives of people with ID (n=8; [22, 45, 50, 63, 66, 69, 81, 103]). Evaluation-oriented studies assessed co-design methods, technologies, or user experiences (n=3; [2, 58, 92]) and activism-oriented research focused on

Research Aim	Classification Description	Publication Count	References
Exploration-Oriented	Studies that investigate emerging areas of co-design, identifying challenges and opportunities, or expanding theoretical and practical understandings of co-design with people with ID.	12	[5, 8, 9, 15, 26, 35, 41, 72, 74, 79, 106, 107]
Intervention-Oriented	Studies that identify key issues affecting individuals with ID and then leverage co-design methodologies to produce interventions that address concerns while creating new opportunities for support and engagement.	8	[22, 45, 50, 63, 66, 69, 81, 103]
Evaluation-Oriented	Studies that assess the effectiveness of co-design methodologies, measure participant engagement, or examine the usability and impact of co-designed solutions.	3	[2, 58, 92]
Activism-Oriented	Studies that aim to challenge systemic barriers and empower individuals with ID through inclusive research practices.	2	[20, 83]

Table 2: Classification of co-design study aims.

advocacy and rights, challenging systemic barriers to empower people with ID through participation (n=2; [20, 83]). Exploratory studies examined topics such as understanding users and their experiences (n=7; [5, 8, 26, 35, 41, 79, 107]), methods supporting the participation of people with ID in co-design (n=3; [9, 72, 74]) and their self expression (n=2; [15, 106]). Intervention-focused research predominantly addressed understanding the capabilities of technology (n=3; [22, 45, 81]) and skill development (n=2; [50, 63]). One study each focused on communication [66], employment [69], and navigation [103]. Studies with an evaluative aim (n=3; [2, 5, 58]) examined the use of technologies and reflected on lessons learned, while advocacy-oriented research (n=2; [20, 83]) sought to support the agency and autonomy of people with ID through co-design.

The research contributions [105] of the reviewed studies were classified into four categories (see Table 3). The key contribution of the reviewed publications was primarily empirical (n=15; [2, 5, 8, 20, 22, 26, 45, 63, 66, 79, 81, 83, 103, 106, 107]), generating new knowledge through observation, data collection, and analysis to offer evidence-based insights for theory and practice. Artifact-based contributions (n=6; [22, 26, 50, 69, 79, 106]) focused on creating tools, prototypes, systems, or conceptual designs through design-driven research. Methodological contributions (n=5; [15, 35, 58, 74, 92]) advanced research or design practices by introducing new methods, refining existing ones, or improving participatory processes. Lastly, theoretical contributions (n=4; [9, 41, 72, 74]) developed or refined concepts, frameworks, or principles to guide understanding and decision-making in HCI. No dataset, survey or opinion contributions were identifed across the corpus. Empirical contributions included evaluations of technology efficacy (n=7; [2, 8, 20, 22, 83, 103, 106]), user experience insights (n=5; [5, 45, 63, 66, 79]), research process insights (n=3; [26, 63, 81]), and design considerations (n=2; [5, 107]). Artifact contributions included assistive technology hardware (n=2; [79, 106]), assistive technology software (n=2; [50, 69]), novel hardware (n=2; [22, 104]), and a toolkit (n=1; [26]). Methodological contributions advanced the understanding of co-design practices (n=4; [15, 35, 74, 92]) or introduced novel co-design methods (n=1; [58]). Theoretical contributions involved applying knowledge across disciplines (n=3; [41, 72, 74]) and proposing a novel research theory (n=1; [9]).

Across the included studies, co-designers reflected a wide spectrum of IDs. Co-designers described under the umbrella term of ID, without specified severity, were the most frequently reported condition (n=13; [2, 8, 9, 15, 20, 22, 35, 58, 63, 69, 74, 92, 103]). Where severity levels were noted, most involved individuals with mild (n=7; [2, 5, 26, 41, 81, 83, 107]) or moderate (n=6; [2, 41, 81, 83, 106, 107]) intellectual disabilities, few included severe ID (n=2; [81, 106]). Co-occurring ASD and ID, was present across a quarter of studies (n=6; [2, 15, 20, 58, 103, 106]) as well as few specific ID conditions, such as Down syndrome (n=4; [45, 58, 81, 106]), profound and multiple learning disabilities (n=3; [45, 58, 79]), and Williams syndrome (n=2; [45, 106]).

Reporting of participant demographics varied greatly across the corpus, ranging from diagnostic labels and cognitive assessments to descriptive accounts of co-designers' interests and needs. Twenty-two papers reported participants with ID using clinical diagnostic labels [2, 5, 9, 15, 20, 22, 26, 35, 41, 45, 50, 58, 63, 69, 72, 79, 81, 83, 92, 103, 106, 107]. Arvola et al. (2023) further provided the digital short version of Raven's Progressive Matrices 2 (RPM 2), a non-verbal test typically used to measure general human intelligence and abstract reasoning, to ten of their sixteen participants with IDs [5]. Seven studies offered descriptive accounts of co-designers' interests, capabilities and challenges [8, 9, 50, 74, 79, 92, 107]. For example, Sitbon & Farhin (2017) [92] shared contextual detail about participants' communication and smartphone-use abilities. Only one paper explicitly reported support needs instead of diagnostic information, with Balasuriya et al.'s (2024) work noting a support ratio of one support worker to four participants at a DSO [8]. Similarly, Wu et al. (2024) [107] explicitly recruited participants based on functional abilities, such as being capable of understanding and communicating for interpreting and representing data, rather than through cognitive assessments.

Research Contribution	Classification Description	Publication Count	References
Empirical	Contributions that generate new knowledge through systematic observation, data collection, and analysis.	15	[2, 5, 8, 20, 22, 26, 45, 63, 66, 79, 81, 83, 103, 106, 107]
Artifact-Based	Contributions that emerge from design-driven research, focusing on the creation of new tools, prototypes, systems, or conceptual designs.	6	[22, 26, 50, 69, 79, 106]
Methodological	Contributions that advance research or design practices by introducing new methods, refining existing methodologies, or improving research processes.	5	[15, 35, 58, 74, 92]
Theoretical	Contributions that develop new or refined concepts, frameworks, principles, or definitions that shape our understanding of the HCI field.	4	[9, 41, 72, 74]

Table 3: Classification of co-design study contributions.

Across the reviewed studies, the dominant term used to describe people with ID involved in co-design was "participants" (n=17; [2, 5, 8, 9, 15, 20, 22, 26, 41, 50, 63, 72, 81, 92, 103, 106, 107]). One study adopted the term participants based on the expressed preference of individuals with ID [103]. Descriptors of "co-designers" appeared in one study [35] as well as the role of people with ID being described as "students" in two papers [58, 83]. The terms "co-researchers" [45], "partners" [69], "collaborators" [74], and the direct use of a child with ID's name [79] each appeared only once. Notably, several studies described people with ID as co-designers in their abstracts, introductions, or conclusions, but reverted to the more conventional label of participants in the body of the paper.

5 Co-Design Method Utilisation

The studies employed a variety of methods to facilitate co-design with people with ID, combining well-established HCI approaches with adaptations to suit co-designers' needs. Methods were first examined deductively to identify the types of techniques used to support co-design with people with ID, including when in the design process they were employed and how they facilitated participation. Building on this initial mapping, methods were then grouped inductively based on their primary function within the co-design process and the type of participant engagement they enabled (see Table 4). Across the corpus, these methods tended to cluster around three broad phases common to co-design practice, being exploration, ideation and evaluation, reflecting how researchers sought to understand contexts, generate design possibilities and assess outcomes. This generalised model provides the organising structure for the results presented in this section.

The taxonomy we propose is underpinned by the co-design parameters that emerge from this literature review, which collectively highlight how methods were augmented or adapted to support meaningful participation of people with ID when designing technologies. Co-design methods are characterised less by the choice of technique than by their orientation toward enabling co-designers to actively shape design outcomes. In this review, we analyse methods identified in the corpus as serving co-design goals, though they may not traditionally be seen as a standard 'co-design' methods.

Interviews (n=16) and prototyping (n=14) were the most frequently used co-design methods, often forming the basis of iterative design processes. Focus groups and group discussions (n=11), workshops (n=11), and observational or ethnographic approaches (n=10) were also common for gathering insights and generating ideas. Surveys and questionnaires (n=6) created opportunities for structured evaluation, while methods such as brainstorming (n=3) and affinity diagramming (n=2) supported idea generation and sense-making.

The settings for co-design activities varied across the reviewed studies, with almost half (44%) conducted in environments familiar to co-designers. 11 studies were conducted in familiar contexts such as schools [5, 45, 58, 83], ID-specific centres [2, 9, 26, 74, 103], or co-designers' homes [79]. These environments were commonly chosen as familiar settings to enhance the comfort and engagement of co-designers with ID [26]. By contrast, 4 studies were set in unfamiliar contexts such as university campuses [8, 66, 106] or museums [81]. In some cases, an unfamiliar setting was a deliberate methodological choice; Woodward et al.'s (2023) study sought to reframe the power dynamic between researchers and co-designers by positioning them as experts and co-researchers within a university setting [106]. Two studies adopted hybrid arrangements [63, 107] and approximately a third of the corpus (32%) did not explicitly report the setting in which the co-design activities took place [15, 20, 22, 35, 41, 50, 69, 92].

In the following subsections, we analysed the 20 methods used to engage people with ID and their support networks in co-designing technologies. We categorised the methods into four groups: Verbal & Discussion-Based, Observational & Contextual Inquiry, Creative Modes of Engagement, and User Experience & Usability Testing. We then analysed the strategies used to facilitate participation and highlight the methodological adaptations that enhanced the suitability of these approaches for co-design with people with ID.

Method	Count	References
Verbal and Discussion Based Methods		
Interviews	16	[2, 5, 9, 15, 20, 22, 26, 45, 58, 63, 72, 79, 81, 83, 92, 107]
Focus Group / Group Discussion	11	[20, 35, 45, 58, 63, 69, 72, 74, 81, 83, 106]
Scenarios	2	[5, 20]
Observational and Contextual Inquiry Methods		
Observation / Ethnography	10	[5, 15, 22, 45, 58, 72, 74, 79, 83, 92]
Case studies	1	[15]
Contextual Inquiry	1	[74]
Diary study	1	[20]
Creative Modes of Engagement		
Prototyping	14	[9, 15, 22, 26, 50, 58, 66, 69, 74, 79, 83, 92, 103, 106]
Workshop	11	[2, 5, 8, 9, 22, 26, 72, 83, 103, 106, 107]
Brainstorming	3	[20, 66, 103]
Affinity Diagramming	2	[58, 66]
Collage	2	[8, 58]
Drawing	2	[58, 106]
Role Playing	2	[5, 58]
Empathy Map	1	[35]
Journey Mapping	1	[58]
User Experience & Usability Testing Methods		
Survey / Questionnaire	6	[5, 9, 22, 26, 58, 72]
Usability testing	4	[41, 50, 63, 81]
Personas	2	[58, 74]
System Usability Scale	2	[22, 103]

Table 4: Frequencies of methods referred to as part of the co-design process with and for people with ID.

Consistent with our search strategy and inclusion criteria, this review focuses on the processes and practices of co-design with and for people with ID, rather than the outcomes of co-design; as such, we did not analyse artefacts or other design outputs.

5.1 Verbal and Discussion-Based Methods

5.1.1 Interviews. Interviews were one of the most frequently reported methods, present in 16 co-design publications [2, 5, 9, 15, 20, 22, 26, 45, 58, 63, 72, 79, 81, 83, 92, 107]. Across the reviewed studies, interview types included semi-structured [22, 58, 63, 72, 74, 92], and contextual [9, 15] approaches. People with ID (n=6) alongside academics & specialists (n=5) were the most frequent interviewees, followed by caregivers or proxies (n=4). Fewer studies reported interviewing mixed groups, such as people with ID and caregivers or proxies (n=2), and specialists and caregivers (n=1).

Interviews were used across all phases of co-design. In the exploratory stage, academics and specialists were consulted to ground the research context and inform design directions [20, 45, 74]. Interviews with people with ID were conducted during both exploratory and evaluative phases to capture perspectives and gather feedback on concepts or prototypes [2, 63, 81, 92, 107]. For example, Bayor et al.'s (2021) method focused paper identified people with ID's technology-use patterns to inform subsequent co-design workshops [9], while Sitbon and Farhin (2017) used interviews as a familiarisation activity in early research [92]. Caregivers and proxies, including parents and teachers, were engaged to contribute insights during both exploratory and evaluative stages. Brereton et al. (2015) conducted contextual interviews with teachers to inform early design directions and follow-up interviews with parents after application trials [15]. Other studies involved pre-design interviews with parents to capture goals [72], regular meetings to iterate on interventions [79], and interviews with co-teachers to reflect on process [58]. Several studies engaged multiple stakeholder groups at different stages, interviewing academics and specialists in foundational phases and people with ID and caregivers for evaluative feedback [5, 20, 83].

Across the reviewed studies, a range of strategies were reported for conducting interviews in ways that were more inclusive for people with ID. Building trusting relationships and establishing familiarity were emphasised as essential foundations for facilitating open and meaningful interview dialogue [5, 45]. Murphy et al.'s (2022) study demonstrated how one-to-one user testing interviews could be designed in line with established accessibility standards, including best-practice solution design principles and the Web Content Accessibility Guidelines (WCAG) 2.1 [63]. In some cases, carers acted as proxies during interviews, contributing beyond their own perspectives to support co-designers with ID in articulating their ideas and needs, and helping interviewers interpret and record responses accurately [79, 92]. Interviews also served as an adaptable method in Cha et al.'s (2021) paper, where people with IDD were uncomfortable in group contexts, individual interviews were used to provide a more comfortable setting for sharing information [20]. This flexible use of interviews aligns with the study's activism-focused aim, to explore how technology might support the autonomy and daily lives of people with disabilities, reflecting a commitment to reducing exclusionary contextual barriers and centring participants' preferences and comfort in the co-design process.

5.1.2 Focus Groups & Group Discussions. Focus groups were reported in 11 studies, most frequently during the exploratory (n=8) or evaluative (n=5) co-design research phase. Focus groups were used for establishing project goals and values [74] and to collaboratively analyse and evaluate co-design outcomes and processes [58, 83, 106]. Only one study employed focus groups across all phases of the co-design process, conducting five separate sessions aligned with each stage of the design thinking framework (Empathise, Define, Ideate, Prototype, and Test) [35]. Another employed focus groups to enable co-analysis and reflection upon the design process with people with ID [106].

Across the reviewed papers, focus group studies provided varying levels of participant detail, ranging from specific numbers, demographic details and session durations to more general descriptions of participant roles. People with ID were most commonly engaged in focus groups, exclusively featured in three studies [20, 63, 81]. Of the studies that reported focus group sizes, participant numbers ranged from 2 to 8 individuals. An exception was Cha et al.'s study, in which one individual completed the focus group activity by themselves due to parental preferences against interaction with other adolescents [20]. Studies also saw people with ID complete focus groups with academics & specialists [35, 58], teaching assistants [45], or both [106]. These studies tended to host larger focus groups, with up to 20 participants with ID involved [35], who were typically positioned as advisory contributors [106]. Academics and specialists were included in five focus group studies [35, 58, 69, 74, 106], where they contributed domain expertise.

To increase participation and support meaningful contributions, several studies adapted their focus group methods and approaches. Smaller group sizes of two to three were used to create a more comfortable discussion environment for people with ID [20], and one study also employed alternative communication methods, such as drawing, to accommodate abilities [81]. Additionally, adapted and custom tools, including an empathy map, managing expectations, and 'I like, I wish, What if' exercises, were used to support the collection of insights from people with ID during focus groups [35]. However, concerns with the efficacy of focus groups for inclusive co-design were raised with a participant from Lowy et. al's (2024) study describing the format as "very question and answer" noting that it "didn't really get to the core of the design" and ultimately did not support their research aims [58].

5.1.3 Scenarios. Scenarios were used in 2 papers to support co-design activities with people with ID. Both studies applied scenarios during ideation and evaluation phases, with children with ID [5] and adolescents with ID [20]. By situating abstract technologies, such as autonomous buses and conversational agents, within familiar storylines and dialogue scripts, scenarios reduced cognitive demands and enabled co-designers to express expectations, concerns, and desired features.

5.2 Observational and Contextual Inquiry Methods

5.2.1 Observation & Ethnography. Methods of observation were reported in 10 studies and applied across all phases of co-design. Observation was used during exploratory and evaluative phases of co-design [15, 22]. Two studies also used observation exclusively to understand situated practices [58, 74] through on-site visits at maker communities and disability service organisations (DSOs). Observation was also used across all three phases of co-design in two studies [79, 83], where design ideas emerged directly from observed behaviours and were later evaluated through continued observation of technology use. Saridaki and Mourlas' [83] experience-focused, activism-oriented study used observation to document empowerment and trace shifts in students' self-determination, engagement and motivation.

One study each employed observation solely for ideation [72] or evaluation [45], while another used observation to examine the co-design process itself and assess affordances and limitations of specific methods [92]. All studies conducted in-person observations, with the exception of Robinson et al. (2020), who used remote data collection through third-party software to carry out observations in the family home of a non-verbal child with profound learning difficulties [79]. This remote approach respected the privacy of the home environment while capturing rich, contextual insights into daily routines and interactions.

5.2.2 Longitudinal & Situated Methods. Contextual inquiry, case studies, and diary studies were used in singular instances across the corpus to capture the behaviours of co-designers and their engagement with technology artefacts. Contextual inquiry was applied as 'background work' [74], with the aim to build contextual knowledge of diverse stakeholder practices and to understand existing technology infrastructures for people with ID. This method involved semi-structured interviews and on-site observations with makers, university students and academics, as well as a DSO. The contextual inquiry served to identify design approaches, motivations, values, challenges, and factors that supported the sustainability and success of community collaboration.

Diary studies were used to test and evaluate a voice-based conversational agent (VCA) with participants with ASD and co-occurring ID [20]. Participants were initially asked to complete structured diary sheets with text prompts to reflect on their use of the VCA and evaluate its usability. However, the researchers acknowledged the challenge of some participants feeling compelled to record entire conversations due to obsessive tendencies, making the diary task burdensome. To address this, the method was adapted, with participants instead encouraged to capture short videos of their interactions with the VCA on a mobile phone.

Case studies were used reflectively to describe the lessons learnt from applying a *design after design* [30] co-design approach with two different ID demographic groups [15]. The two case studies were found to enrich the view of the other and highlight the adaptive differences when accommodating the diverse abilities of children and adults with ID.

5.3 Creative Modes of Engagement

5.3.1 Workshops. Workshops were widely used across studies, employed in both generative and evaluative phases of co-design (n=9) or during the ideation phase alone (n=2). The frequency of workshops ranged from single workshops [5] to an extended series of up to twelve [103]. Of the corpus, workshops were commonly formatted as two sessions, one focused on ideation and one on evaluation (n=3; [26, 106, 107]). However, an equal number of studies reported several or an unspecified number of workshops completed [9, 72, 83]. Participant groups varied, most commonly involving people with ID and their professional caregivers (n=6; [2, 8, 9, 26, 72, 103], and people with ID alone (n=5; [5, 9, 83, 106, 107]). The reported conditions of people with ID who participated in the workshop included mild ID (n = 3; [5, 83, 107]), mild-to-moderate ID (n = 2; [83, 107]), and diagnoses such as Williams syndrome (n = 1; [106]), Down syndrome (n = 3; [9, 106, 107]), and ASD (n = 3; [9, 106, 107]). Additionally, one study utilised design session workshops with experts, specialists and a neurotypical child [22].

To support the participation of people with ID, facilitators emphasised equal partnership in the design process [22] and created non-evaluative workshop environments that encouraged active involvement and shared decision-making [2, 26, 83]. Engagement was further fostered through creative formats, with workshops described as theatrical [5], multi-sensory [72], and fictionalised through playful narratives such alien settings [107]. Accessible strategies included keeping discussions short, providing interactive tasks, and clarifying both workshop goals and participant roles as co-designers [106]. Workshops were responsive to participants' abilities and interests, with activities adapted in situ. This was seen in Woodward et al.'s [106] experience-focused study, where sketching was replaced with 3D modelling when drawing proved challenging. Additionally, two studies employed custom ID-focused 'TechShops' [8, 9], a workshop-based alternative to contextual interviews designed to engage young adults with ID in exploratory research. TechShops use collaborative, hands-on activities with mainstream technologies, peer teaching, and structured support to build trust and reduce technology intimidation [10].

5.3.2 Prototyping. Prototyping was the second most frequently used method in the corpus, supporting development of interactive design artefacts in physical and digital forms. Most often (n=7; [15, 22, 26, 58, 69, 79, 106]), it was used during ideation and evaluative phases to generate ideas and elicit feedback on design features. In several cases, idea generation discussion around an initial prototype was followed by an evaluation of subsequent versions [26, 69, 106]. In two instances, prototypes were first used for evaluative purposes to then spark future design iterations, described as a '*design after design*' approach [15, 79]. Prototyping was also employed exclusively for ideation (n=4; [66, 74, 83, 92]), often as probes to stimulate discussion [92]. Fewer studies focused only on evaluation (n=2; [50, 103]) or combined exploration and evaluation through technology probes to observe usability and engagement (n=1; [9]) with key design features.

Prototypes ranged from high-fidelity (n=4; [50, 74, 92, 106], to low-fidelity (n=2; [22, 83]). One study combined rapid and high-fidelity prototyping, in which prototypes developed by professionals and caregivers were redesigned into a high-fidelity web-based system [66]. Prototyping typically involved researchers, people with ID, and professional support staff (n=9; [15, 26, 58, 69, 74, 83, 92, 103, 106]). Few studies engaged professionals, specialists, and caregivers alongside researchers, without people with ID directly participating (n=2; [22, 66]). Notably, only a single study involved people with ID in the construction of prototypes [58], as this often required technical skills (such as soldering) that were described as not being accessible to participants [106].

Iteration was central to prototyping, with at least 11 studies explicitly describing cycles of redesign to provide participants with multiple opportunities for feedback [9, 15, 22, 26, 50, 58, 66, 69, 79, 103, 106]. Prototypes provided concrete and immediate feedback that helped participants with ID understand how proposed technology solutions function and the kinds of interactions they made possible [15, 26, 106]. They also revealed real, unexpected uses, with prototypes being appropriated in ways unimagined by designers and caregivers [15]. The use of incomplete prototype features was also shown to stimulate ideation, shifting participants into more active design roles [92]. Despite their value, prototypes also raised inclusion challenges. People with ID were frequently excluded from construction activities, restricting their involvement to providing spoken feedback on design outcomes [106]. Technical limitations of prototyping software further constrained participation [92]. In one case, prototypes were withheld from participants as they were deemed insufficiently accessible, highlighting tensions between pragmatic ethics and the aspiration for full inclusivity [69].

5.3.3 Generative and Ideation Methods. Brainstorming, drawing, and collaging were used to support the articulation of design challenges and the generation of new technology solutions. Brainstorming was used with specialists, professionals, and families of people with ID to identify communication challenges in the context of schools [66] and explore augmented reality design ideas [103]. Brainstorming was also used with people with ASD and ID to imagine features of a VCA agent without being constrained by current technical limitations [20].

Drawing was used to support idea expression among people with ID, particularly those with limited verbal communication abilities [58]. One study used drawing to illustrate a tangible interface for mental wellbeing by highlighting features participants considered important [106], while another used drawing to create storyboards of envisioned scenarios with a robot dog [58]. Linking these drawings to tangible research outputs (such as 3D prints) proved effective; however, not all participants were able to complete the task of drawing an interface [106].

Collage was used as an ideation exercise, allowing participants to create visual representations of hardware design ideas. Balasuriya et al.'s (2024) study provided collage materials (such as pictures of robot parts, coloured pens and tape) and invited participants to construct robots, describing their features and uses [8]. Similarly, Lowy et al.'s (2024) work tasked participants with creating visual representations of a robot dog [58]. The collage process enabled participants to express preferences for the kinds of robots they wanted to interact with, while supporting the contributions of both verbal and non-verbal participants [8].

5.3.4 User Representation Methods. Role playing was used as a way to explore how people with ID might respond to potential challenges when using new technologies. In one study, students with ID acted out how a robot dog should behave when it failed, either taking on the role themselves or directing a mentor to perform as the dog [58]. Another study organised a co-design workshop with five children with ID to explore the concept of self-driving buses [5]. Participants played out a bus ride scenario constructed with chairs, mats, and cardboard props. This role-playing approach elicited spontaneous problem-solving strategies and emotional responses that revealed where confusion and anxiety arose during scripted point of friction. These reactions informed design recommendations for more transparent and supportive autonomous transport systems.

Personas were also used to represent users with ID and communicate their perspectives to design teams. In one case, students with ID created personas from small datasets of information as a way of defining the research challenge [58]. Conversely, Rajapakse et al.'s (2018) study developed design profiles based on real participants with ID to provide to a team of volunteer designers [74]. These design narratives were successful in communicating participants' unique needs and preferences, ensuring that the design outcome was grounded in lived experiences rather than fictional abstractions.

5.3.5 Structuring and Sense-Making Methods. Affinity diagramming was used to categorise and prioritise challenges identified during brainstorming activities [58, 66] and to analyse data collected from a co-design workshop [5]. After specialists, professionals, and family members generated 171 sticky notes on communication challenges faced by students with autism in educational settings, the research team collaboratively grouped the contributions to find areas of consensus [66]. In another study, students with ID engaged with digital affinity mapping using virtual sticky notes [58]. While participants understood the principle, some reported feeling "overwhelmed" by large datasets and found the task difficult to manage. The researchers responsively divided the data into smaller sets, which was found to improve cognitive engagement and enabled participants to develop skills in analysing data.

Journey mapping was used in one study [58], where students with ID collectively envisioned the job search journey of a persona while sharing stories from their own lived experiences. In Fernandez-Rivera et al.'s (2022) study, empathy mapping was introduced at the outset to clarify problems faced by co-designers and provide designers with insights to build upon [35]. This method helped participants articulate issues they might otherwise have been reluctant to raise directly, offering a structured way to express needs and frustrations. However, the "what do you do?" quadrant proved challenging, requiring further explanation due to its abstract nature.

5.4 User Experience & Usability Testing Methods

5.4.1 Usability Testing. Four studies employed usability testing, applied either to co-designed prototypes or to existing digital resources. Murphy et al. (2022) conducted 15 iterative rounds of testing, both online and in person, of an accessible digital skills education programme, combining researcher observation with semi-structured interviews and applying accessibility guidelines such as WCAG 2.1 to inform iterative modifications [55, 63]. Howard et al. (2021) similarly evaluated three app prototypes through a one-hour expert-based session with six individuals with ID who were highly familiar with the content, drawing on their workshop-teaching experience to assess design outcomes [50]. Two additional studies focused on usability testing of existing technologies rather than co-designed prototypes [41, 81]. These examined a museum website and a tablet application through task-based activities that surfaced participants' likes, dislikes and navigation preferences; both studies emphasised the need for simple, well-supported tasks and highlighted the facilitatory role of educators and support workers in enabling meaningful participation and feedback.

5.4.2 Survey and Structured Feedback Methods. Surveys and questionnaires were employed in six studies to collect data on participants' technology use, user experience, and design preferences [5, 9, 22, 26, 58, 72]. One study administered a simplified Technology Readiness Index (TRI 2.0) to children with mild ID using picture support [5], while another used the User Experience Questionnaire (UEQ) in Spanish to enable benchmarking against prior UX studies [22]. Surveys were also directed at professionals and families, where special-education professionals completed questionnaires after workshops [26], and parents provided semesterly updates on technology use and their children more broadly [72].

While useful for capturing patterns of use, researchers noted limitations, as some participants perceived the surveys as resembling tests [9]. To address this, a researcher familiar with the participants delivered the survey, and participants were encouraged to bring their own devices. This helped contextualise discussions and enabled minimally verbal participants to demonstrate how they used apps.

System Usability Scale (SUS) questionnaires were used in two studies to evaluate design solutions [22, 103]. Cibrian et al. (2017) used the standard SUS, while Westin et al. (2024) developed an "inclusive SUS" (iSUS). Questions were rephrased in situ by support staff to ensure comprehension, and semi-structured notes were taken to capture both participant responses and staff interpretations. However, this adaptation reduced comparability across participants.

6 Discussion

This paper examined how people with ID have been involved in co-designing technology by synthesising commonly used methods, adaptations for inclusive participation, and the strengths and limitations of these approaches. In the following discussion, we examine how language and representation shape power dynamics in co-design, analyse the value of concrete and narrative-driven methods for supporting participation, and propose evidence-based principles and approaches to guide more adaptive and equitable co-design practice.

Table 5: Key principles for including people with ID in co-design, with descriptions and examples.

Principle	Description	Examples in Action
Competency-Based Design Approach	A competency-based design approach builds on users' existing technology use to identify their strengths and abilities. These competencies are then leveraged by selecting or adapting methods that accommodate diverse communication, cognitive, and physical needs, and are further developed through engagement with the design solution itself [9].	Using a custom method such as *Co-Design Beyond Words* with minimally verbal children, following their interests, building on their abilities, and supporting interaction [104]; or paired drawing in focus groups to accommodate diverse contribution modalities among people with ID [81].
Little & Often Iteration over Extended Timescales	A sequenced and, iterative approach over time builds familiarity and trust over time, while providing repeated opportunities for engagement.	Applying the *Active Support* tenet of "Little and Often" to offer graded exposure to co-design tasks and prevent aversion to participation [12]; or employing a timescale of hundreds of engagement hours with a toolkit for skill development and to build sustainable relationships [32].
Supportive Environments	Co-design should take place in familiar, comfortable settings and actively account for co-designers' support networks [77]. Carers and support professionals help create a safe and enabling context that reduces anxiety, supports communication, and allows co-designers with ID to contribute meaningfully.	Almost two-thirds (65%) of the studies that reported their research settings were conducted in familiar environments. Non-evaluative atmospheres reduced pressure on co-designers [2, 26, 83] and carer facilitated communication support the interpretation of responses and co-constructing insights to inform the design process [15, 79, 81, 92].
Reframing Power through Language & Representation	Recognising people with ID as knowledgeable contributors through the adoption of co-determined, strength-based language.	Involving a person with ID as an active co-researcher, contributing to project planning, ideation, analysis and dissemination [42], or employing identity descriptors based on the preferred forms of self-identification among individuals with ID [103].
Narrative, Situated, and Concrete Approaches	Anchoring co-design in familiar, story-driven, and context-rich activities supported by concrete objects and tangible materials that reduce abstraction and support diverse communication styles.	Using low-fidelity or incomplete prototypes as concrete props that people with ID could manipulate to ground ideas in lived experience [74, 90, 92, 106], and by transforming abstract data into playful, interest-led, personalised artefacts and stories [107].
Triangulation of Mixed Methods	Employing multiple methods and triangulating across them accommodates diverse modes of expression and enhances the validity and completeness of the perspectives captured in the study [16, 52].	Combining observations, interviews, workshops, and quantitative measures enabled co-designers with ID to express their perspectives in multiple ways and allowed researchers to validate findings across methods [5, 22, 74, 79].
Leveraging Accessibility Standards	Of the corpus, seven studies (28%) incorporated established accessibility standards, including Easy Read formats, simplified language, and picture supports [2, 5, 35, 41, 58, 63, 81]. The relatively low uptake of accessibility standards represents a missed opportunity to apply an evidence-based means of enhancing the inclusivity of co-design materials.	Adapting one-to-one user testing interviews to be designed in line with established accessibility standards, including best-practice design principles and the WCAG 2.1 [63]; or modifying the Technology Readiness Index (TRI 2.0) using simplified language and picture support [5].

6.1 Language, Representation, and Power

Our review highlights tensions in the co-design process involving people with ID, particularly concerning the language used to describe them and their representation in publications and design outputs. Terminology varied considerably, with ‘participants’ most frequently used (n=17; 68%), explicitly justified in only one study based on the preference of individuals with ID [103]. We highlight that the language choice of ‘participant’ carries implicit judgments about agency, reinforcing traditional ‘researcher–researched’ power dynamics and underplaying the expertise that co-designers contribute [33, 73, 102]. Haidenhofer et al. (2024) offer a counterexample by documenting the evolving role of an individual with ID who transitioned from research participant to co-designer and ultimately co-researcher within a long-term social robotics project [42]. Their contribution was formally acknowledged through ‘co-researcher’ identification and primary authorship. However, the study also highlighted the systemic barriers that limit the formal recognition of contributions by people with ID and other underserved groups, including assumptions about who qualifies as a ‘researcher’ and publication practices that privilege credentialed expertise over lived experience. Language carries power, with the labelling that researchers use reinforcing or disrupting existing hierarchies [27, 34, 96]. This requires researchers to critically reflect on the language they use and to responsively convey how people with ID describe and conceptualise themselves [17]. Using more relational and empowering labels also challenges the stigma historically associated with ID [46] and supports more inclusive research practices where individuals are recognised as agents, authorities and co-enquirers rather than respondents [40]. Co-design and PD inherently create opportunities for individuals to articulate their values and identities [23], underscoring the importance of providing people with ID the agency to communicate alternate identity preferences, such as co-designer or co-researcher, that may more accurately reflect their roles and contributions.

The review highlighted that studies primarily engaged people with mild to moderate ID, while those with severe or profound ID were rarely included. Exclusion was often attributed to communication challenges inherent in methods reliant on verbal interaction [12]. As shown in our review there is a continued reliance on diagnostic labels and IQ scores, with 88% of the corpus papers employing diagnostic labes to describe participants. This further obscures the functional, contextually-dependent, abilities of people with ID and offers little insight into how participation might be supported [86]. The continued use of these measures reflects the influence of the medical model of disability, which primarily frames ID in terms of deficits, emphasising diagnostic classifications and psychometric measures [62, 76]. Such impairment-focused labels have become normalised and are often required for ethics processes and publication standards [59]. Consequently, researchers may default to diagnostic labels not because they enhance co-design, but because they are embedded within longstanding clinical and academic structures. While recognising the unique needs of people with ID in research is essential, providing contextual descriptions offer readers a deeper understanding of the study conditions and the methodological choices made. In our review, the seven studies that reported co-designers’ communication styles, interaction patterns, and support strategies were able to more clearly justify their methods-based decisions, enabling more personalised forms of methodological support and infrastructuring [74]. Recognising the importance of contextualised participant information, scholars increasingly call for a shift from abstract diagnostic classifications toward reporting individualised support needs (e.g., low, medium, high) across functional domains relevant to the study; such as communication, daily living, and social interaction [86, 101]. This approach not only aligns with strength-based models of disability but also fosters inclusive design practices that are responsive to diverse capabilities, particularly for those historically marginalised in research.

Inclusive co-design with people with ID is not achieved through alternative terminology, but through transforming mindsets and institutional structures to redefine how knowledgeable contributors are recognised. When researchers use co-determined identities and design studies around individual support needs, rather than deficits, they centre lived experience as a source of epistemic authority and shift power toward more accessible forms of agency [37]. Embedding such practices can transform a ‘faux-design’ [95] consultative approach into one of genuine collaboration, enabling people with ID to be recognised not just as contributors, but as partners in knowledge production.

6.2 Non-Abstract, Narrative-Driven Co-Design

Several studies have identified the value of using narrative-driven, non-abstract objects and examples to support people with ID to overcome potential technology exclusion barriers, comprehend abstract concepts, and answer questions with greater accuracy [24, 89, 92]. Concrete thinking refers to the preference or need for tangible, specific, and observable information over abstract concepts, and is a well-documented approach in the field of education [3, 14]. In co-design contexts, this underscores the importance of providing multi-sensory, physical, or experiential representations of ideas to support comprehension, engagement, and meaningful participation [15, 24].

In our review, prototyping emerged as a particularly effective non-abstract method for translating design concepts into tangible, interactive forms [15, 92, 106]. Low-fidelity or incomplete prototypes enabled people with ID to interpret, manipulate, and build upon ideas in ways that reflected their lived experiences and perspectives [74, 90, 92, 106]. These prototypes anchored the process in concrete co-design, turning abstract ideas into tangible artefacts that people with ID could explore, interact with, and respond to, enabling them to understand and influence how the technology would work in practice.

However, a gap remains in accessible tools for participatory prototype creation. Technical barriers in electronics, fabrication, and software can hinder hands-on involvement, especially for those with higher support needs [92, 106]. Recent research has begun to address this gap through the design of specialised toolkits. González et al.’s ideation toolkit uses tangible construction tools and narrative supports to scaffold creative expression during participatory play [93]. Gennari et al. also developed IoTgoID, a rapid-prototyping toolkit, which combines card-based interactions, 3D-printed artefacts, and embedded electronics to make the building of smart devices tangible and accessible to people with ID [39]. Together, these studies demonstrate that with appropriate supports, people with ID can move beyond evaluation roles to engage meaningfully in prototype creation processes.

Storytelling was also identified as an effective strategy for situating technologies within familiar contexts. For instance, Arvola et al. (2023) used a theatrical, storytelling set-up to introduce an unfamiliar and problematic situation where people with ID were forced to interact with an autonomous bus [5]. Conversely, Wu et al. (2024) transformed raw data into compelling personal narratives that bridge abstract numbers and human experiences to make data visualisation accessible to people with ID [107]. Narrative acted as a cognitive bridge, translating abstract concepts into relatable experiences that enhanced comprehension, emotional engagement, and meaningful contributions from people with ID. These narrative-based approaches align with findings that people with ID may benefit from experiential, story-driven formats for comprehension or to explore speculative design possibilities [47, 57, 93].

This review suggests that non-abstract, narrative-driven approaches, whether applied through prototyping, storytelling, or the use of specialised creative tools, are essential for enabling accessible co-design with people with ID. Concrete artefacts and narrative function as complementary techniques in co-design, with tangible prototypes grounding abstract ideas in physical form and narrative framing situating them within familiar contexts [93]. Together, these mutually reinforcing modalities enhance comprehension, emotional engagement, and the capacity of people with ID to contribute meaningfully to shaping design outcomes. However, further research is needed to explore how these approaches can be scaled, sustained, and adapted across diverse contexts, levels of support needs, and stages of the co-design process.

6.3 Principles & Approaches Toward Adaptive Co-Design

Our review consolidates a breadth of methods and approaches within HCI academic discourse on co-designing technology with and for people with ID, drawing together how researchers have adapted, extended, and sometimes struggled to modify established practices to support meaningful participation. Across the corpus, co-design with people with ID emerges as more than a matter of methodological choice alone. Rather, researchers must navigate complex ethical, social, and epistemic tensions that shape participation, including scaffolding communication, addressing power asymmetries, and creating environments in which co-designers can contribute on their own terms.

Our literature review has identified a number of key principles and approaches that support co-design for and with people with ID, emphasising intentional methodological design and reflexive attention to the conditions that enable genuine contribution. The principles we introduce synthesise patterns that emerged across studies and translate them into actionable guidance for researchers seeking to conduct inclusive co-design. In Table 5, we present these principles as simple, guiding statements to support decision-making throughout the co-design process. Rather than prescriptive rules, they function as conceptual anchors distilled from our review, offering a foundation that can be adapted to diverse contexts, abilities, and project aims.

7 Limitations

This review has several limitations. First, our analysis is limited by what authors chose to report, which may present a partial view of participatory practices, particularly in relation to power dynamics and co-designer's influence. Second, the corpus was weighted toward studies involving individuals with mild to moderate ID, limiting insights into co-design with those with severe or profound disabilities. Third, we excluded grey literature and non-academic design work, which may offer further perspectives on inclusive methods. Finally, our findings reflect research published up to January 2025 and do not capture more recent developments in this evolving field.

8 Conclusion

This scoping review provides a novel synthesis of how people with ID have been included in co-design, mapping methods used, adaptations made, and the roles co-designers most often assumed. Across the 25 studies, our analysis revealed that interviews, workshops, and prototyping were the most common approaches, frequently adapted through simplified language, visual supports, and iterative cycles to improve accessibility. From these findings, we derived principles for inclusive co-design: building on co-designer competencies, using incremental and iterative approaches to foster trust, embedding established accessibility standards, conducting co-design in supportive environments and adopting mixed-method triangulation. These principles provide actionable guidance for designing studies that enable meaningful and sustained co-design participation with people with ID.

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A Appendix

A.1 Review Search & Screening Process

Full search string: ("intellectual disabilit*" OR "cognitive disabilit*" OR "developmental disabilit*" OR "neurodevelopmental disorder" OR "intellectual impairment" OR "cognitive impairment" OR "developmental impairment" OR "neurodevelopmental impairment") AND ("co-design" OR "co design" OR "participatory design" OR "co-making" OR "co-research" OR "cooperative design" OR "collaborative design").

Screening Iterations: *Title & Abstract Screening* formed the first iteration, in which two authors independently reviewed titles and abstracts for potential eligibility based on the core inclusion criteria. This included peer-reviewed papers focused on co-design with people with ID and involving a technology-related project. This phase was completed over 12 sittings. *Full Text Screening:* comprised the second iteration, with two authors independently examining full texts to confirm eligibility and determine whether studies provided sufficient methodological detail for inclusion. This phase was conducted over 8 sittings.

Discrepancies or uncertain cases at either stage were resolved through consensus discussions with the full author team, ensuring shared agreement in alignment with the defined scope of the review.

A.2 Overview of the Corpus

The table below presents an overview of the studies included in the review corpus. Papers are grouped by co-design focus and ordered by year of publication, summarising key study characteristics.

Table 6: Overview of the Corpus grouped by Co-Design Focus, then ordered by Year.

Author	Co-Design Focus	Co-Designers	Research Aim	Research Contribution	Phases of Co-Design	Co-Design Methods Employed
			Experience-Focused Studies Studies that focus on the lived experience of co-designers or on the experience enabled by the co-designed solution.			
Saridaki & Mourlas, 2014 [83]	**Experience:** Students with ID using serious games.	People with ID & Caregiver	Activism-Oriented	Empirical	Exploration, Ideation	Interview, prototyping, focus group / group discussion, workshop, observations / ethnography
Pihlainen et al., 2017 [72]	**Experience:** Parents' participatory involvement in activities.	People with ID & Caregiver	Exploration-Oriented	Theoretical	Ideation, Evaluation	Interview, focus group / group discussion, observation / ethnography, workshop, survey / questionnaire
Robinson et al., 2020 [79]	**Experience:** Exploring needs of a child with ID and their family.	People with ID & Caregiver	Exploration-Oriented	Empirical & Artifact-Based	Exploration, Ideation	Interview, observation / ethnography, prototyping
Arvola et al., 2023 [5]	**Experience:** Autonomous bus ride experiences for children with mild ID.	People with ID & Caregiver	Exploration-Oriented	Empirical	Exploration, Ideation	Interview, observation / ethnography, workshops, surveys / questionnaire, scenarios, role playing
Acton et al., 2024 [2]	**Experience:** Virtual reality healthcare intervention.	People with ID & Caregiver	Evaluation-Oriented	Empirical	Exploration, Ideation, Evaluation	Interview, workshop
Wu et al., 2024 [107]	**Experience:** Co-designing data visualisations.	People with ID	Exploration-Oriented	Empirical	Exploration, Ideation	Interview, workshop
			Method-Focused Studies Studies that explore, adapt, or generate co-design methodologies, frameworks, or approaches.			
Brereton et al., 2015 [15]	**Method:** "Design after design" as an engagement model.	People with ID & Caregiver & Academic/Specialist	Exploration-Oriented	Methodological	Ideation, Evaluation	Interview, prototyping, observation / ethnography, case studies
Rajapakse et al., 2018 [74]	**Method:** Personal infrastructuring approach.	People with ID & Caregiver & Academic/Specialist	Exploration-Oriented	Methodological & Theoretical	Exploration, Ideation	Focus group / group discussion, observation / ethnography, contextual inquiry, prototyping, personas
Bayor et al., 2021 [9]	**Method:** Competency-based co-design approach.	People with ID	Exploration-Oriented	Theoretical	Exploration, Ideation	Interview, prototyping, workshop, survey / questionnaire

Author	Co-Design Focus	Co-Designers	Research Aim	Research Contribution	Phases of Co-Design	Co-Design Methods Employed
Cosentino et al., 2021 [26]	**Method:** Co-designing COBO, an ideation toolkit.	People with ID & Caregiver	Exploration-Oriented	Empirical	Exploration, Evaluation	Interview, prototyping, workshop, survey/questionnaire
Fernandez-Rivera et al., 2022 [35]	**Method:** Application and validation of co-design methods.	People with ID & Academic/Specialist	Exploration-Oriented	Methodological	Exploration, Ideation, Evaluation	Focus group / group discussion, empathy mapping
Woodward et al., 2023 [106]	**Method:** Participatory co-design for mental well-being tangibles.	People with ID & Caregiver	Exploration-Oriented	Empirical & Artifact-Based	Exploration, Ideation, Evaluation	Focus group / group discussion, prototyping, workshop, drawing
Guedes et al., 2024 [41]	**Method:** Framework for scaffolding collaborative design.	People with ID	Exploration-Oriented	Theoretical	Ideation, Evaluation	Usability testing
Lowy et al., 2024 [58]	**Method:** Adaptations of co-design activities.	People with ID & Academic/Specialist	Evaluation-Oriented	Methodological	Exploration, Ideation, Evaluation	Interview, focus group / group discussion, observation / ethnography, prototyping, affinity diagramming, collage, drawing, role playing, journey mapping, survey / questionnaire, personas

Technology-Focused Studies

Studies that center on the design and development of technology systems or artefacts.

Parsons et al., 2016 [69]	**Technology:** Co-designing an online TimeBank.	People with ID & Academic/Specialist	Intervention-Oriented	Artifact-Based	Exploration, Ideation, Evaluation	Prototyping, focus group / group discussion
Cibrian et al., 2017 [22]	**Technology:** Co-designing BendableSound.	People with ID & Caregiver & Academic/Specialist	Intervention-Oriented	Empirical & Artifact-Based	Ideation	Interview, observation / ethnography, prototyping, workshop, survey / questionnaire, System Usability Scale
Sitbon & Farhin, 2017 [92]	**Technology:** Co-designing a public transport mobile application.	People with ID & Caregiver	Evaluation-Oriented	Methodological	Exploration, Evaluation	Interview, observation / ethnography, prototyping
Cha et al., 2021 [20]	**Technology:** Appropriating voice-based conversational agents.	People with ID & Caregiver & Academic/Specialist	Activism-Oriented	Empirical	Exploration, Ideation	Interview, focus group / group discussion, scenarios, diary study, brainstorming

Author	Co-Design Focus	Co-Designers	Research Aim	Research Contribution	Phases of Co-Design	Co-Design Methods Employed
Howard et al., 2021 [50]	**Technology:** Training application to recognise abuse.	People with ID & Caregiver & Academic/Specialist	Intervention-Oriented	Artifact-Based	Ideation, Evaluation	Prototyping, usability testing
Harris et al., 2022 [45]	**Technology:** Validating a virtual reality environment.	People with ID & Caregiver	Intervention-Oriented	Empirical	Exploration	Interview, focus group / group discussion, observation / ethnography
Murphy et al., 2022 [63]	**Technology:** Co-designing DigiAcademy.	People with ID	Intervention-Oriented	Empirical	Exploration, Evaluation	Interview, focus group / group discussion, usability testing
O'Rourke et al., 2022 [66]	**Technology:** Co-designing a communication application for students with ID.	Caregiver & Academic/Specialist	Intervention-Oriented	Empirical	Exploration, Ideation, Evaluation	Prototyping, brainstorming, affinity diagramming
Guedes et al., 2023 [81]	**Technology:** Co-designing ACCESS+.	People with ID	Intervention-Oriented	Empirical	Exploration, Evaluation	Interview, focus group / group discussion, usability testing
Balasuriya et al., 2024 [8]	**Technology:** Co-designing robots.	People with ID & Caregiver	Exploration-Oriented	Empirical	Exploration, Ideation	Workshop, collage
Westin et al., 2024 [103]	**Technology:** Co-designing assistive AR applications.	People with ID & Caregiver	Intervention-Oriented	Empirical	Exploration, Ideation, Evaluation	Prototyping, workshop, brainstorming, System Usability Scale