

# Explore Motor Skills Development in Individuals with Profound Intellectual Disabilities through Collaborative Art Creation

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## Abstract

This study presents a preliminary qualitative exploration of Fundamental Movement Skills in aging individuals with profound intellectual disabilities who resist physical activities. Six participants engaged in a large-scale collaborative art workshop. We categorized existing motor skills demonstrated and explored art's potential as a motivational tool for further motor skill development. Observations and survey findings revealed current motor competencies and provided design recommendations for the HCI community, emphasizing inclusive interventions to enhance motor skills and promote engagement.

## CCS Concepts

• **Human-centered computing** → *Empirical studies in accessibility*.

## Keywords

Intellectual Disabilities, Motor Skills, Art Creation

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## 1 Introduction

"Many of them resist physical activities — that's what concerns us," shared the director of a disability supporting center, K, in Chiba, Japan, during our fieldwork. "For our users — individuals with profound intellectual disabilities — understanding the concept of health and why they need physical activities is challenging. However, for

their families and us as caregivers, encouraging physical activity and maintaining their health is such a critical mission."<sup>1</sup>

Individuals with intellectual disabilities (ID) experience significantly lower levels of physical activity (PA) compared to the general population, with over 80% failing to meet the World Health Organization's recommended PA guidelines [7]. This inactivity contributes to heightened risks of obesity, cardiovascular diseases, and musculoskeletal disorders [13]. Neurologically, atypical brain development in regions responsible for motor control, such as the cerebellum and corticospinal tracts, often leads to deficits in gross motor skills (e.g., balance, coordination) and perceptual-motor integration (e.g., timing, spatial awareness)[5]. Combined with cognitive limitations, such as difficulties in understanding abstract concepts such as "health benefits" [14], these challenges contribute to resistance toward PA.

Fundamental Movement Skills (FMS), also referred to as fundamental motor skills or gross motor skills, are widely regarded as the "building blocks" of physical activity [4]. FMS include locomotor skills (e.g., running, jumping) and object control skills (e.g., throwing, catching) that underpin participation in sports and daily activities, and FMS must be explicitly learned and practiced [2]. While FMS research has traditionally focused on early childhood education, emphasizing this period as crucial for establishing life-long physical activity patterns, recent studies have broadened the scope to include adults and older adults, particularly those at risk of motor decline and fall-related injuries [2]. For individuals with IDs, research has primarily addressed children and adolescents, highlighting FMS deficits compared to Typically Developing (TD) peers and informing early interventions [12]. Building on this foundation, emerging approaches such as asset-based and competency-based models in Human-Computer Interaction offer new opportunities to explore existing strengths rather than focusing solely on skill deficits [3]. Additionally, while much attention has been given to early developmental stages, there is growing interest in understanding how FMS evolve in adulthood, particularly among older adults with ID.

This poster paper presents a preliminary qualitative study conducted with support center K for aging adults with profound IDs

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<sup>1</sup>Homepage of Koikei Supporting Center website: <http://www.e-shinseikai.or.jp/kssc/> (access date: 2025/1/1)

who resist traditional physical activities but prefer art-based activities. The study addresses two research questions: **"RQ1: What are the existing motor skills in individuals with profound IDs through a competency-based lens?"** and **"RQ2: How can art-based activities support motor skill development?"** We designed a large-scale adaptive art workshop with six participants, inviting them to create a 3m x 1.5m handprint painting on a wall-mounted canvas in a 5m x 10m space. We conducted detailed observations during the workshop and performed survey interviews with caregivers to gain a comprehensive understanding of existing motor skills and the impact of art-based activities. Our contributions are summarized as follows: (1) identified existing motor skills in aging individuals with profound IDs, offering a competency-based perspective, and (2) provided design recommendations for the HCI community, emphasizing art-based interventions to enhance motor skills and engagement.

## 2 RELATED WORK

### 2.1 FMS for Individuals with Profound IDs

Clark defined Fundamental Movement Skills (FMS) as "gross motor skills that involve the large force-producing muscles of the trunk, arms, and legs" [6]. Barnett et al. and Logan et al. categorized FMS into three main types: (1) object control skills (also known as ball skills or manipulative skills), which involve manipulating and projecting objects, including actions such as catching, kicking, and throwing; (2) locomotor skills, which require the body to move through space, including activities such as walking, running, jumping, hopping, and skipping, and (3) stability skills, which focus on maintaining stability and control, encompassing movements such as body rolling, bending, and one-foot balance [2, 11]. The Test of Gross Motor Development (TGMD-2) [15] is a commonly used tool for assessing FMS, particularly in studies involving children and adolescents with mild to moderate IDs. However, existing measurement tools often struggle to accurately evaluate individuals with profound IDs, creating a gap in current assessment methods [8]. This gap is significant because research shows that lower motor skill proficiency—which is often associated with greater ID severity—can lead to physical, social, and psychological challenges [12].

### 2.2 Art Creation for Individuals with IDs

Art therapy uses the creative process as a form of nonverbal communication, helping individuals express thoughts and emotions, promoting healing and well-being [1]. It is effective for children, adults, and individuals needing special care, focusing on personal growth, self-understanding, and emotional support. Adaptive art extends this approach by making art-making practices accessible to individuals with disabilities, emphasizing creative potential over the artistic product [10]. It simplifies tools, media, and techniques to overcome barriers, promoting inclusion and expanding accessible arts [9].

## 3 Workshop Study: Methodology

### 3.1 Art Workshop Design: Handprint Zoo

The "Handprint Zoo" art workshop was designed through a year of ethnographic research with the care supporting center, aiming

to provide an engaging and inclusive experience for participants with profound IDs. The workshop focused on two key considerations: (1) natural engagement through art: Participants preferred art activities like painting and crafting over traditional physical activity (PA) programs. They valued tangible outcomes, enjoying the opportunity to display their creations, take them home, or enter them in competitions. To maintain spontaneity, the workshop was framed as an artistic experience rather than a motor skills exercise; and (2) addressing exercise challenges: Unlike dynamic art activities, existing exercise programs at the care center were limited to following gymnastics videos or walking, which were less engaging and often difficult for participants to understand. The workshop aimed to incorporate movement naturally through creative tasks.

Participants collaboratively created a large-scale, 3m x 1.5m zoo-themed cotton canvas artwork. Materials included animal-themed paints and decorative stickers (see Figure 1). The simple process involved selecting an animal, applying paint to their hands, pressing handprints onto the canvas, and adding decorations with stickers or freehand drawings.

### 3.2 Participants

Six participants (P1-P6) and three caregivers (C1-C3) participated in the workshop. According to the Japanese classification system, all participants were classified as having a Level 6 intellectual disability, indicating the most profound level of cognitive and adaptive impairments. Individuals at this level typically require full assistance in daily activities and exhibit significant limitations in communication and mobility.

### 3.3 Procedure



**Figure 1: (A) Art sample demonstrating how to create animals using handprints: selecting colors, stamping handprints, and applying templates. (B) Participant P3 stamping their handprint during the workshop. (C) The completed zoo-themed artwork.**

During the one-hour session, participants were first invited to a practice activity where each created a bird, representing a local mascot, which they could take home as a keepsake. Participants voluntarily raised their hands to approach the whiteboard and complete the practice task. Following this, the main "Handprint Zoo" activity began. Participants engaged in a step-by-step process: applying paint to their hands, making handprints on the canvas, washing their hands, and adding decorative elements to their creations. Each participant contributed 2 to 4 animal-themed pieces, resulting in a total of 20 creative outputs.

Participant	Gender	Age	Disabilities and Level
P1	Female	76	Profound Intellectual Disability
P2	Female	48	Profound Intellectual Disability
P3	Female	45	Profound Intellectual Disability
P4	Female	75	Profound Intellectual Disability & wheelchair use (leg injury)
P5	Male	50	Profound Intellectual Disability
P6	Male	57	Profound Intellectual Disability

**Table 1: Participant Demographics**



**Figure 2: (A) P3 needing caregiver support vs. P2 independently placing handprints; (B) P3 jumping energetically; (C) P4 standing from a wheelchair to reach stickers and wash hands.**

## 4 Workshop Findings

Comprehensive observations and recordings of the entire workshop process were conducted to document participants' behaviors and interactions, providing deeper insights into their engagement and artistic expressions. Semi-structured interviews with C1 to C3 were also carried out to complement observational data and capture personal reflections. To address our research question, we analyzed participants' performances through the lens of FMS, focusing on two key dimensions: Object Control Skills, and Locomotor Skills (see Figure3), since the workshop did not involve activities requiring advanced balance or stability.

### 4.1 Existing Motor Skills

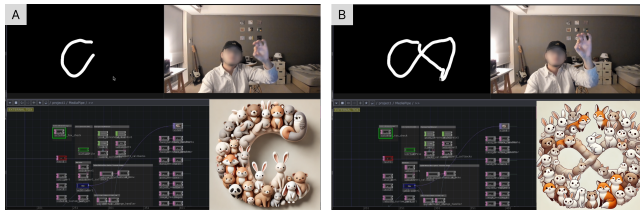
**Object Control Skills** : participants displayed varying degrees of object control skills, particularly in managing art materials, such as handling paintbrushes, applying handprints, and peeling stickers.

- **Well-developed skills:** Some participants (e.g., P1, P2) exhibited a solid foundation in fine motor skills, engaging with art tools and demonstrating appropriate hand-eye coordination. For example, P1 showed an ability to adapt their hand movements to match the required print orientation. When creating a second handprint, P1 managed to select a different color and apply paint with consistent effort, resulting in a clear handprint. P2 engaged in sticker-related tasks, including peeling and placing stickers on the canvas. During the process, P2 took time to choose stickers, showing a level of thoughtfulness in their approach. While handling delicate stickers, P2 was able to avoid damaging them, indicating adequate control of hand movements.

- **Emerging skills:** Participants like P4 and P5 exhibited basic object control skills but required facilitator support to complete tasks. Their engagement was primarily guided, suggesting a need for structured assistance to fully participate.
- **Limited engagement:** P3 and P6 demonstrated minimal interaction with objects. P3 primarily engaged through social interactions but occasionally interacted with art materials, particularly stickers. During moments of increased interest, P3 would briefly handle stickers, often applying them gently to the canvas. However, P3's attention frequently shifted back to conversations, indicating that verbal communication was a stronger draw than object-based tasks. P6 displayed minimal engagement with art tools, showing more interest in social dynamics. P6 preferred to watch others, clap along, and participate verbally rather than physically interact with the materials. Their hand movements included waving and gesturing, suggesting that P6 valued social connections over hands-on artistic expression.

**Locomotor Skills:** it includes walking, jumping, pacing, and transitions between seated and standing positions:

- **High mobility:** P1, P2, and P3 demonstrated good locomotor skills, moving confidently between stations, taking an estimated 50 to 85 steps each. They actively used the physical space, often walking to explore or engage in social interactions. P1 maintained a steady pace, primarily navigating between the paint station, canvas area, and sink with purpose-driven movements. Their transitions involved consistent walking rhythms and minimal assistance, even when maneuvering around obstacles. P2 exhibited spontaneity in movement, occasionally walking to socialize rather than focusing solely on task-related activities. They displayed a curiosity-driven approach, briefly engaging with peers' artwork and initiating short conversations while moving. The most dynamic participant was P3, who combined walking with jumping and hopping. P3 not only walked to the paint station but also engaged in playful movements, including 8 jumps in place and 3 hops back to their seat. These movements were expressive, often accompanied by verbal cues like "Made it!", which added a social and emotional dimension to their physical engagement.
- **Moderate engagement:** P5 and P6 showed moderate locomotor activity, moving between stations with occasional prompts. P5 maintained a slow pace, often staying close to caregivers but occasionally navigating the space independently, balancing caution with exploration. P6 paced frequently, especially during social interactions, demonstrating mobility and a preference for dynamic engagement with others.
- **Restricted movement:** As a wheelchair user due to a leg injury, P4 did not demonstrate traditional locomotor skills. Notably, with C2's support, P4 stood up for approximately three minutes to reach stickers, showing initiative and a willingness to engage physically beyond their usual seated posture. This shift indicated both physical capability and a growing comfort in exploring more active participation during the workshop.



**Figure 3: (A) Hand-Trajectory Tracking and AI Painting (In Progress); (B) Hand-Trajectory Tracking and AI Painting (Final Stage).**

## 4.2 Developed Motor Skills

The art workshop fostered growth in motor skill development, with caregivers observing notable improvements in participants' physical activity and engagement through three distinct examples. P6, who typically avoided movement, showed a marked increase in physical activity by standing and sitting repeatedly and pacing around the workshop space. According to a caregiver, *"There was a significant increase in physical activity; it was great to see them move more than usual."* (C1), highlighting how the workshop provided a valuable opportunity for P6 to enhance their mobility. P4, who uses a wheelchair due to a leg injury, demonstrated increased willingness to engage physically by standing up with caregiver C2's support. Additionally, P3 exhibited high energy and enthusiasm through frequent jumping during the workshop, including both spontaneous jumps in place and playful hops back to their seat. Caregivers noted that P3's jumping not only demonstrated improved gross motor skills but also served as an emotional outlet, showcasing how physical expression can contribute to emotional and social engagement in a creative setting.

## 5 Discussion

While emerging technologies often integrate physical activity and art through intuitive and interactive systems [16], individuals with profound IDs still struggle with even low-cognitive-load technologies due to limited comprehension and interaction skills. Our workshop showed that even with manual, step-by-step guidance — such as "place your hand here" — some participants found it difficult to follow instructions. This suggests that instead of expecting participants to understand technology, HCI researchers should focus on embodied and intuitive art-making methods to enhance physical engagement and support motor skill development without high cognitive demands. Our future prototype system uses MediaPipe<sup>2</sup> and pressure sensors in a carpet to track participants' movement paths, feeding data into real-time image-generation AI models like Stable Diffusion (see Figure 3). By turning physical movement into creative input, we aim to keep interactions simple, preserve creative freedom, and encourage active participation. Future work will explore providing real-time feedback and visual encouragement through accessible, low-barrier interaction methods to promote engagement in both art creation and physical activities.

<sup>2</sup>Mediapipe website: <https://ai.google.dev/edge/mediapipe/solutions/guide> (access date: 2025/1/1)

## 6 Conclusion

Through observing the FMS of six participants during the art workshop, we propose the potential of using intuitive art creation as a future approach to support FMS development in individuals with profound IDs. This study highlights how engaging, embodied art activities can offer a promising alternative to traditional motor skill training methods, promoting both physical engagement and creative expression.

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