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Case Study

Improving Adaptive Functioning and Quality of Life in an Adolescent with Down syndrome through Integrated Functional and Life Skills Training: A Case study

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Abstract

Adolescents with Down syndrome frequently experience limitations in physical functioning, adaptive abilities, and independence in daily living activities, which significantly impact their overall quality of life and capacity for community participation. This case study examined whether an integrated intervention combining functional training and life skills training would improve both quality of life and independence in daily activities for a 16-year-old adolescent with Down syndrome. A single-case study design was implemented over 8 weeks with 3 training sessions per week conducted at a special school setting. The intervention integrated functional training with life skills training. Quality of life was assessed using the KIDSLIFE-Down Scale, and functional independence in activities of daily living was measured using the Waisman Activities of Daily Living Scale. Both assessments were completed at pre and post-intervention. Results demonstrated improvements in overall quality of life across multiple domains on the KIDSLIFE-Down Scale, and meaningful gains in independence across several self-care and daily living activities on the Waisman Activities of Daily Living Scale. Observational data documented increased confidence, enhanced engagement in functional tasks, and greater willingness to attempt new activities. This case study suggests that an integrated approach addressing both physical capabilities and practical life skills provide a more comprehensive pathway to improving quality of life and independence in adolescents with Down syndrome.

1. Introduction

Down syndrome, resulting from trisomy 21, remains one of the most common chromosomal causes of intellectual and developmental disability, occurring in approximately 1 per 700 live births across most regions [1]. Advances in medical care and health management have extended life expectancy substantially—individuals with Down syndrome now commonly live into their 50s and 60s [2], compared to much shorter life spans in previous generations. This extended longevity has fundamentally transformed how we approach support and intervention. Rather than focusing solely on survival and basic medical management, services now prioritize helping individuals with Down syndrome achieve greater independence, participate meaningfully in their communities, and experience improved quality of life throughout their lifespan [2, 3]. This shift creates both an opportunity and a challenge: educators, rehabilitation professionals, and service providers must develop comprehensive, evidence-based interventions that address the real-world barriers to independence experienced by adolescents and adults with Down syndrome.

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Adolescents with Down syndrome typically experience interconnected physical and cognitive limitations that significantly restrict their daily functioning. On the physical side, individuals often demonstrate hypotonia (reduced muscle tone), decreased muscular strength, impaired balance and postural control, and limited cardiovascular endurance [4]. Concurrently, cognitive and adaptive challenges—including delays in processing speed, working memory, and executive function—create difficulties with self-care, social communication, and practical life skills [5]. Importantly, these limitations do not exist in isolation. They interact in complex ways that can make independence particularly challenging. Consider a practical example: an adolescent might intellectually understand the steps required for safe bathroom hygiene but lack the leg strength and balance to safely stand from a toilet independently. Conversely, someone with adequate physical strength might struggle to sequence the multiple steps involved in a self-care routine. These interconnected barriers underscore why interventions must address both physical and cognitive-adaptive dimensions simultaneously. Research has consistently shown that individuals with Down syndrome face elevated rates of obesity, cardiovascular disease, and sedentary lifestyles compared to the general population [4]. Systematic reviews identify physical inactivity, weak muscular strength, coordination difficulties, and overall functional limitations as key risk factors for developing secondary health conditions that compound existing challenges [3]. These physical limitations create a ripple effect: they directly restrict participation in daily activities, limit community engagement, and reduce overall quality of life. Hartman and colleagues [3] demonstrated that youth with stronger motor skills and better physical fitness show significantly better independence in self-care tasks and community participation. Without intervention, the restrictions on independence and community participation experienced during adolescence often establish patterns of dependence that persist into adulthood, making early intervention particularly important.

Beyond physical capacity, adolescents with Down syndrome frequently struggle to acquire the practical life skills necessary for independence—bathing, dressing, toileting, meal preparation, household management, and community participation skills [5]. These adaptive behavior deficits are major drivers of continued dependence on caregivers and limited community access. Research has shown that direct instruction in task-analyzed life skills can produce meaningful improvements in adaptive functioning and independence [5, 6]. However, life skills training often falls short in real-world practice. A critical barrier emerges when underlying physical limitations prevent an adolescent from executing a skill that has been taught. Teaching someone the steps for independent dressing, for example, provides limited benefit if the individual cannot balance while pulling on pants or lacks the fine motor coordination to manage buttons and zippers. This reality highlights a fundamental gap: traditional approaches that teach life skills in isolation, without simultaneously addressing physical prerequisites, are unlikely to produce lasting, functional independence. Quality of life has emerged as a critical measure of intervention success in disability research. Schalock and colleagues [5] define quality of life as encompassing multiple life domains: physical health and well-being, emotional functioning, meaningful relationships, personal development, self-determination, social inclusion, and basic rights and dignity. For individuals with intellectual disabilities, quality of life is determined not only by objective functional capacity but also by subjective well-being, perceived autonomy, meaningful engagement, and sense of personal agency. Traditional rehabilitation approaches have emphasized treating specific impairments in isolation—physical therapy for balance, occupational therapy for fine motor skills, special education for academics. While these component-specific interventions can improve discrete impairments, research consistently shows they often fail to translate into meaningful improvements in real-world independence, quality of life, or community participation [5]. This gap between isolated impairment reduction and functional improvement has prompted a growing recognition that interventions must be integrated and functionally oriented—designed to produce real-world improvements that matter in adolescent's daily lives.

Both functional training (systematic exercise targeting strength, balance, coordination, and endurance) and life skills training (direct instruction in adaptive behaviors using task analysis and behavioral techniques) have established effectiveness as separate interventions. However, research specifically examining their combined effects in adolescents with Down syndrome remains sparse. Theoretically, an integrated approach should produce synergistic effects: gains in physical capacity (such as increased leg strength or improved balance) combine with direct training in practical procedures (such as safe toilet transfers) to produce comprehensive improvements in functional independence that exceed what either approach could achieve alone. Furthermore, teaching life skills in ecologically valid contexts—practicing balance during kitchen tasks, incorporating strength training into household chores—may enhance the transfer of learning to real-world settings and improve the durability of gains beyond formal intervention [3, 6]. Given this gap in the literature, the present single-case study was designed to examine whether an eight-week integrated intervention combining functional training and life skills training would produce meaningful improvements in both objective measures of functional independence and subjective quality of life in an adolescent with Down syndrome. By examining these outcomes together, this study aims to contribute evidence regarding an integrated approach that may help bridge the gap between isolated skill improvement and meaningful, functional independence in daily life.

2. Intervention Protocol and Study Design

A single-case experimental design was conducted over an eight-week intervention period. The participant was a 16-year-old adolescent with Down syndrome .The participant attended a specialized school setting .The participant received 24 training sessions of 60 minutes each, conducted three times weekly (Monday, Wednesday, Friday). Unlike specialized facilities, sessions conducted place in ordinary classroom within the regular school building. Table 1 presents eight – week intervention schedules. Each session consisted of 30 minutes of functional training (addressing balance, strength, coordination, and mobility) and 30 minutes of life skills training (addressing self-care, household management, communication, and daily living tasks).

3. Case Study Presentation

The participant was a 16-year-old adolescent with Down syndrome (trisomy 21). He was able to walk independently and had functional verbal communication skills, speaking in 4–5 word sentences and understanding two-step directions when given contextual cues. Intellectual functioning was estimated in the mild-to-moderate range (IQ approximately 40–55). He had no significant medical comorbidities and was not currently receiving physical therapy, occupational therapy, or formal life skills training through school. Despite these capabilities, the adolescent experienced substantial limitations in activities of daily living that restricted his independence and significantly burdened his family. In self-care activities, bathing and showering required substantial caregiver assistance due to difficulties managing water temperature and navigating wet surfaces safely. Dressing required moderate assistance, particularly when managing fasteners such as buttons and zippers. Toileting required caregiver supervision and hands-on assistance, especially for hygiene management and verification. He required physical

Table 1: Eight-Week Integrated Intervention Schedule

Week	Functional Training	Life Skills Training
Week 1	Walking, sit-to-stand, squatting, reaching, basic balance activities	**Personal hygiene:** Hand washing, face washing, tooth brushing, grooming
Week 2	Balance walking, stepping, low step-ups, bending and carrying light objects	**Dressing & personal care:** Wearing/ removing clothes, folding clothes, arranging personal belongings
Week 3	Walking with direction changes, obstacle walking, reaching and grasping	**Eating skills:** Using spoon, drinking from a cup, arranging and clearing eating materials, cleaning after eating.
Week 4	Functional strengthening through sit-to-stand, squatting, carrying and pushing/ pulling light objects	**Household skills:** Cleaning and arranging table, books and other materials, putting waste in the correct bin.
Week 5	Step-ups, walking circuits, balance and carrying objects	**School-related skills:** organizing desk , Packing school bag, organizing books, keeping belongings in designated places
Week 6	Walking, reaching, bending, carrying and coordinated movement activities	**Decision – making:** choose between two options , identify safe / unsafe situations , deciding what to do when something goes wrong
Week 7	Functional mobility circuit involving walking, balance, stepping and carrying	**Community skills:** Shopping practice, identifying money, requesting items, basic safety awareness
Week 8	Review and combination of previously learned functional movements	**Integrated independence:** Complete a familiar self-care, household or school task with minimal assistance

assistance transferring to and from the toilet and bed due to balance and strength limitations. While feeding was independent, he was dependent on others for most personal care tasks.Physically, the adolescent demonstrated marked balance impairment with severely limited static standing balance without support. Dynamic balance was significantly constrained, restricting his ability to safely navigate uneven surfaces or crowded community environments. Muscular strength was notably reduced, particularly in the lower extremities and trunk, further limiting his functional mobility and independence in community ambulation. These baseline limitations substantially restricted the adolescent's participation in community activities and imposed considerable caregiving demands on family members. The functional deficits in balance, strength, and self-care skills created barriers to greater independence and community integration.

4. Results

Quality of Life Outcomes

The KIDSLIFE-Down Scale was administered at pre and post-intervention. The total score increased from 72 at baseline to 91 post-intervention, representing an absolute improvement of 19 points. This magnitude of improvement is consistent with findings reported in intervention studies targeting quality of life enhancements in individuals with intellectual disabilities. Navas and colleagues [7], in their validation study of the KIDSLIFE-Down Scale, demonstrated that quality of life interventions producing improvements of 20-30% represent clinically meaningful gains. Examination of eight domain-specific scores revealed improvements across all quality of life dimensions.

Table 2: Kidslife-Down Scale Scores at Pre-Intervention and Post-Intervention

Domain	pre	post	Change
Physical Well-being	9	15	+6
Self-Determination	8	13	+5
Personal Development	11	15	+4
Interpersonal Relations	8	11	+3
Emotional Well-being	7	9	+2
Social Inclusion	9	11	+2
Material Well-being	7	8	+1
Rights	8	9	+1
Total Score	72	91	+19

Table 2 shows comparison of pre-intervention and post-intervention scores across all eight quality of life domains on the KIDSLIFE-Down Scale, and Figure 1 shows the graphical representation these domains. The chart demonstrates consistent improvements across all domains, with the most substantial gains in physical well-being, self-determination, and personal development. Each domain shows measurable improvement in the post-intervention assessment. Physical well-being demonstrated the largest improvement (increase from 9 to 15 points), followed by self-determination (increase from 8 to 13 points) and personal development (increase from 11 to 15 points). Smaller improvements were observed in interpersonal relations, emotional well-being, and social inclusion. Material well-being and rights domains showed minimal change (+1 and +1 respectively).

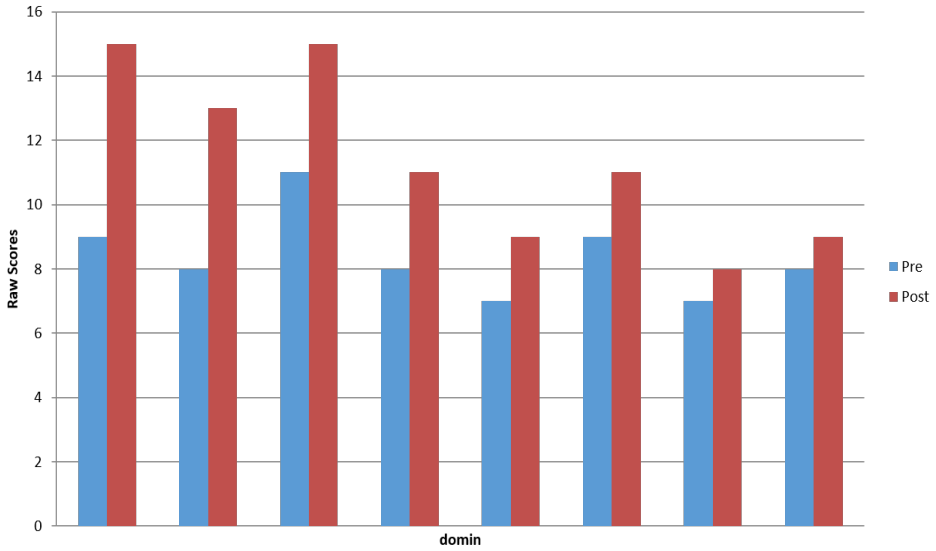

Figure 1: Comparison of Pre- and Post-Intervention Scores Across Quality-of-Life Domains

The substantial improvement in physical well-being aligns with research by Rimmer and colleagues [4], who documented that structured physical training interventions in individuals with Down syndrome produce significant improvements in physical health outcomes and perceived physical well-being. Shogren and colleagues [8] demonstrated that interventions incorporating self-determination principles produce meaningful improvements in psychological well-being and perceived autonomy in individuals with intellectual disabilities.

Functional Independence in Activities of Daily Living

The Waisman Activities of Daily Living Scale was used to measure the participant's functional independence before and after the 8 -week intervention program. His total score improved from 18 at baseline to 28 post-intervention. At pre test, he required help with nearly all daily activities, but by post-intervention, he had achieved complete independence in five major areas including household tasks, medication management, transportation, and money handling. Research by Maenner and colleagues [9] confirms that improvements of this magnitude represent meaningful and lasting gains in daily functioning that genuinely reduce the demands placed on family caregivers. The consistency of these gains across multiple life domains, coupled with the stability of skills he had already mastered, demonstrates that real, purposeful progress occurred rather than random variation. This level of improvement reflects meaningful progress toward greater independence and a tangible improvement in both the participant's quality of life and his family's wellbeing.

Table 3: Activities of Daily Living (ADL) – Pre-Test and Post-Test Scores

Functional Category	Pre-Test	Post-Test	Improvement
Personal Care (Items 6, 8, 9, 10)	8	8	No change
Domestic/Household (Items 1, 2, 4, 5)	2	7	+5 points
Community/Safety (Items 3, 7, 13, 14)	1	5	+4 points
Communication/Admin (Items 11, 12, 15, 16, 17)	5	9	+4 points
Overall independence level	Low (18/34)	Moderate (28/34)	Significant Improvement

Table 3 shows, a comparison of pre-intervention and post-intervention Scores of Activities of Daily Living (ADL), and Figure 2 shows the graphical representation these domains. Down syndrome adolescent have remarkable progress in ability to perform everyday activities independently. Beginning with a W-ADL score of 18 out of 34 (indicating moderate dependence), the participant showed particular strength in basic self-care tasks like eating, bathing, and dressing—skills that typically develop earlier in children with Down syndrome [10]. After receiving targeted training in these specific areas, his total score improved dramatically to 28 out of 34—a gain of 10 points. Most impressively, five activities where he had previously required complete assistance (making his bed, preparing meals, managing medications, using transportation, and handling money) became tasks he could perform entirely independently. The improvement was strongest in the very areas targeted by intervention (household and community skills improved), while his already strong personal care abilities remained stable, suggesting the gains were genuine responses to the structured program rather than random variation. Given that the W-ADL has been validated with excellent reliability and proven sensitive to functional changes in individuals with Down syndrome [9], this substantial improvement reflects meaningful progress toward greater independence and reduced caregiver burden—changes that directly enhance both his quality of life and his family's wellbeing.

Many adolescents with Down syndrome struggle with everyday independence, which affects not just what they can do on their own, but how they feel about themselves and their place in the world. Building the ability to perform daily activities independently and improving overall quality of life are essential steps toward giving young people with Down syndrome the freedom, confidence, and participation in community life that every adolescent deserves. Research shows that when comprehensive, coordinated intervention programs combine hands-on physical training with practical life skills instruction, adolescents with Down syndrome can overcome significant barriers to

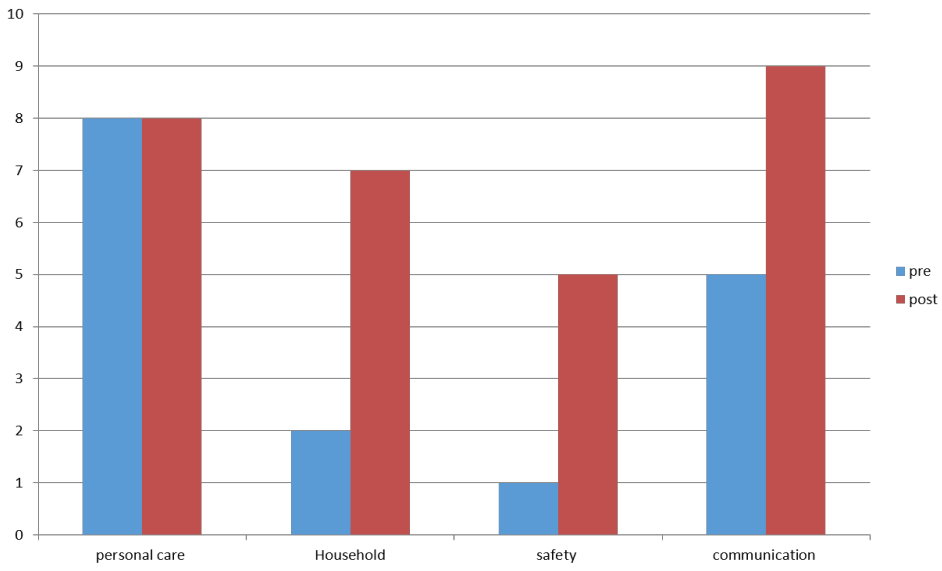

Figure 2: comparison of Pre- and Post-Intervention Scores for Activities of Daily Living

independence—including limited self-care abilities, difficulty managing household tasks, reduced community access, and feelings of dependence. This case study provides evidence that such an integrated approach works: the participant showed substantial improvements in functional independence (improvement on the W-ADL scale) and meaningful gains in overall quality of life improvement (kids life down scale), with particularly striking progress in feeling physically well, having more control over his own choices and experiencing personal growth . Research consistently demonstrates that for adolescents with Down syndrome, social participation, community involvement, and functional independence directly influence their quality of life and sense of belonging [11, 12]. Multiple studies have established that combining different types of support—physical training alongside direct skills teaching—produces better results than trying to address these areas separately, with improvements in physical fitness naturally supporting greater independence in daily tasks [9, 10]. Ecological systems theory, which understands development as happening within interconnected environments where family, school, and community work together, suggests that when services coordinate efforts rather than work in isolation, young people experience more meaningful and lasting change [13].

Article Information

Data Availability Statement: The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Conflict of Interest: The authors declare that they have no conflict of interest.

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Author Contributions: A.B. - Conceptualization, Methodology, Data curation, Formal analysis, Writing – original draft, Writing – review & editing; S.A. - Writing – review & editing, Supervision.

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