FUN-ACT (Functional Rehabilitation for Autism Children Training): Study Protocol for Developing a Functional Rehabilitation Education Model to Improve Activities of Daily Living Independence in Children with Autism Spectrum Disorder

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Abstract. Children with Autism Spectrum Disorder (ASD) commonly experience difficulties in Activities of Daily Living (ADL), including self-feeding, dressing, personal hygiene, and activity transitions, limiting independence and participation. Although functional rehabilitation can improve adaptive functioning, existing interventions are largely therapist-centered and insufficiently integrated into school routines. Scalable school-based rehabilitation models involving teachers and caregivers remain limited, particularly in resource-limited settings. The Functional Rehabilitation for Autism Children Training (FUN-ACT) Program was developed to address this gap by integrating functional rehabilitation strategies into structured classroom activities. To describe the development, validation, implementation, and preliminary evaluation of the FUN-ACT Program as a functional rehabilitation–based educational model to improve ADL independence in children with ASD. This study employs a Research and Development (R&D) design adapted from the Borg and Gall framework, followed by a single-arm feasibility study with a quasi-experimental pretest–posttest evaluation. The study includes needs assessment, model development, expert validation, and implementation in a special education school. The FUN-ACT Program combines functional exercises, task-oriented activities, environmental adaptation, visual supports, and caregiver-assisted learning. Participants include children with ASD, teachers, and caregivers. Primary outcomes are feasibility, content validity, and ADL independence, while secondary outcomes include teacher acceptability, caregiver engagement, and implementation practicality. Data will be analyzed using descriptive quantitative and qualitative methods. The study is expected to produce a feasible, contextually appropriate school-based rehabilitation model that strengthens teacher and caregiver capacity while improving ADL independence among children with ASD, providing preliminary evidence for broader implementation in resource-limited educational settings.

Keywords: Autism Spectrum Disorder; Activities of Daily Living; Functional Rehabilitation; School-Based Intervention; Study Protocol.

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1 Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental condition characterized by persistent deficits in social communication and interaction, accompanied by restricted and repetitive patterns of behavior, interests, or activities [1]. Typically diagnosed between 18 and 24 months of age, ASD often persists throughout the lifespan and substantially affects multiple domains of functioning. The global burden of ASD has increased considerably over the past decade, with prevalence rising from approximately 0.62% in 2012 to 1.0% in 2021, reflecting improved awareness, broader diagnostic criteria, and enhanced screening practices [2]. Beyond its growing prevalence, ASD represents a major public health concern because functional impairments frequently limit children's participation in education, family life, and community activities, thereby increasing long-term support needs for caregivers and healthcare systems [3]. Among the diverse functional challenges experienced by children with ASD, difficulties in Activities of Daily Living (ADL) are particularly important because they directly influence independence, school participation, and long-term quality of life.

Activities of Daily Living (ADL), including feeding, dressing, personal hygiene, bathing, toileting, and functional mobility, are fundamental functional skills that enable children to achieve independence and participate actively in home, school, and community environments [4]. For young children, these everyday occupations also provide essential opportunities for learning, communication, social interaction, and adaptive skill development. However, children with Autism Spectrum Disorder (ASD) frequently experience difficulties in acquiring and performing ADL due to impairments in motor planning, executive functioning, sensory processing, behavioral regulation, and adaptive functioning. Although children and adolescents with ASD often demonstrate relatively better performance in ADL than in communication or socialization domains, their abilities generally remain below age-expected developmental levels [5]. Moreover, these functional limitations often persist across development and may become increasingly pronounced over time, resulting in reduced independence, restricted participation in educational and community activities, and greater caregiving demands. Consequently, improving ADL performance has become a central objective of rehabilitation and educational interventions aimed at enhancing long-term functional outcomes for children with ASD.

Functional rehabilitation is a person-centered approach that aims to enhance children's ability to perform meaningful daily activities by improving functional independence and participation within their natural environments. For children with Autism Spectrum Disorder (ASD), functional rehabilitation commonly focuses on strengthening Activities of Daily Living (ADL) through task-oriented practice, environmental adaptation, visual supports, and caregiver involvement to promote adaptive functioning across home, school, and community settings [6]. However, rehabilitation services remain predominantly clinic-based and therapist-dependent, limiting service accessibility, continuity, and the generalization of acquired skills into

children's everyday routines, particularly in resource-limited settings where access to specialized professionals is often restricted. Embedding rehabilitation strategies within school environments has therefore emerged as a promising approach, as schools provide structured daily routines and repeated opportunities for practicing functional skills in meaningful contexts while fostering collaboration among teachers, caregivers, and rehabilitation professionals. Such school-based interventions not only facilitate consistent implementation and skill generalization but also strengthen the capacity of non-specialist stakeholders to support children's functional development [5]. Nevertheless, structured rehabilitation education models that systematically integrate functional rehabilitation principles into routine classroom activities for children with ASD remain limited, highlighting the need for scalable, contextually appropriate interventions that can sustainably improve ADL independence.

Because children with ASD perform most daily activities within home and school environments, caregiver involvement is considered a critical component of effective rehabilitation [7]. Caregiver-implemented interventions have been recognized as evidence-based practices for children with ASD, with caregiver coaching shown to improve communication outcomes, facilitate intervention implementation, and promote generalization of learned skills across settings. Integrating caregiver participation with school-based rehabilitation may therefore provide a more consistent and sustainable approach to supporting ADL independence [8].

Although various rehabilitation interventions, structured teaching approaches, and caregiver-mediated programs have demonstrated benefits for children with ASD, these interventions are commonly delivered as isolated therapeutic strategies or focus on specific developmental domains, such as communication, social interaction, or behavioral regulation [9]. Existing school-based programs also tend to emphasize educational or behavioral outcomes rather than systematically integrating functional rehabilitation principles into routine classroom activities to improve Activities of Daily Living (ADL) independence [10]. Consequently, comprehensive rehabilitation education models that combine teacher involvement, caregiver-assisted learning, and functional rehabilitation strategies within daily educational practice remain limited, particularly in resource-limited settings.

To address these limitations, the Functional Rehabilitation for Autism Children Training (FUN-ACT) Program was designed as a school-based functional rehabilitation education model that systematically integrates functional rehabilitation strategies into structured classroom routines through collaboration among teachers, caregivers, and rehabilitation professionals. By embedding rehabilitation principles into everyday educational activities, the model aims to promote consistent practice of Activities of Daily Living (ADL) skills while facilitating skill generalization across school and home environments. This study protocol describes the development, validation, implementation, and preliminary feasibility evaluation of the FUN-ACT Program to support ADL independence among children with Autism Spectrum Disorder. Therefore, this study seeks to determine whether a structured school-based functional rehabilitation education model can be feasibly developed and implemented to improve Activities of Daily Living independence among children with Autism Spectrum Disorder.

2 Material and Methods

2.1 Study Design

This study employed a Research and Development (R&D) design adapted from the Borg and Gall framework to develop the Functional Rehabilitation for Autism Children Training (FUN-ACT), a functional rehabilitation education model aimed at improving Activities of Daily Living (ADL) independence among children with Autism Spectrum Disorder (ASD). The R&D approach was selected to ensure a systematic process of model development, refinement, and validation prior to broader implementation [11]. The development process comprised needs assessment, literature review, model design, expert validation, model revision, and pilot implementation [12]. Following the development phase, a single-arm feasibility study using a quasi-experimental pretest–posttest design was conducted to evaluate the feasibility, acceptability, practicality, and preliminary outcomes of the developed model [13]. This phased approach enables iterative refinement while providing initial evidence to support future large-scale effectiveness studies.

2.2 Study Setting and Participants

This study will be conducted at the Autism Special Education School (SLB Autis Laboratorium Universitas Negeri Malang), Malang, East Java, Indonesia, a specialized educational institution that provides educational and developmental services for children with Autism Spectrum Disorder (ASD). The school was selected as the study setting because it offers a structured educational environment that enables the integration of functional rehabilitation strategies into daily classroom routines. Data collection is scheduled to take place from July to August 2026.

Participants will include children with a confirmed clinical diagnosis of Autism Spectrum Disorder (ASD), special education teachers, and primary caregivers who are directly involved in the children's educational and daily care. Children will be recruited using purposive sampling based on predefined eligibility criteria. Eligible participants will be school-aged children with ASD who are able to participate in structured rehabilitation activities and whose parents or legal guardians provide written informed consent. Teachers and primary caregivers will participate in the implementation and preliminary evaluation of the FUN-ACT model, reflecting the collaborative nature of the intervention across school and home settings.

2.3 Development of the FUN-ACT Functional Rehabilitation Education Model

The Functional Rehabilitation for Autism Children Training (FUN-ACT) functional rehabilitation education model was developed using a systematic Research and Development (R&D) approach adapted from the Borg and Gall framework [11]. The development process was informed by a comprehensive literature review on functional rehabilitation, Activities of Daily Living (ADL) interventions, school-based

rehabilitation, visual support strategies, and teacher-mediated interventions for children with Autism Spectrum Disorder (ASD) [14]. A needs assessment was subsequently conducted through direct observation and discussions with special education teachers and rehabilitation practitioners to identify barriers to ADL independence and contextual challenges encountered during daily classroom activities [15]. Findings from the literature review and needs assessment were synthesized to establish the conceptual framework and design of the FUN-ACT functional rehabilitation education model.

The FUN-ACT model integrates four complementary components into routine classroom activities: Functional Physical Exercise, Activities of Daily Living (ADL) Training, Visual Support, and Teacher Coaching. Functional Physical Exercise serves as a preparatory intervention to improve motor readiness required for functional task performance, while ADL Training provides structured and task-oriented practice of essential self-care and daily living skills. Visual Support utilizes schedules, activity cards, and step-by-step prompts to facilitate task comprehension and independent performance, whereas Teacher Coaching equips teachers with evidence-based rehabilitation strategies to ensure consistent implementation and progress monitoring. Collectively, these components are designed to promote functional skill acquisition, facilitate the generalization of learned behaviors across school and home settings, and improve ADL independence through collaborative teacher and caregiver involvement.

The preliminary FUN-ACT model and its accompanying implementation module were subsequently submitted for expert validation involving specialists in pediatric rehabilitation, occupational therapy, special education, and child development to evaluate content relevance, clarity, and practical applicability Recommendations obtained during the validation process were incorporated to refine the model prior to pilot implementation. The revised model will subsequently undergo a preliminary feasibility study to evaluate its feasibility, acceptability, practicality, and preliminary functional outcomes before future large-scale effectiveness studies.

The preliminary FUN-ACT model and its accompanying implementation module were subsequently submitted for expert validation involving specialists in pediatric rehabilitation, occupational therapy, special education, and child development to evaluate content relevance, clarity, and practical applicability. Recommendations obtained during the validation process were incorporated to refine the model prior to pilot implementation, following an iterative intervention development process [16]. The revised model will subsequently undergo a preliminary feasibility study to evaluate its feasibility, acceptability, practicality, and preliminary functional outcomes, thereby informing the design of future large-scale effectiveness studies [13]. he conceptual framework of the proposed FUN-ACT model is illustrated in Figure 1.

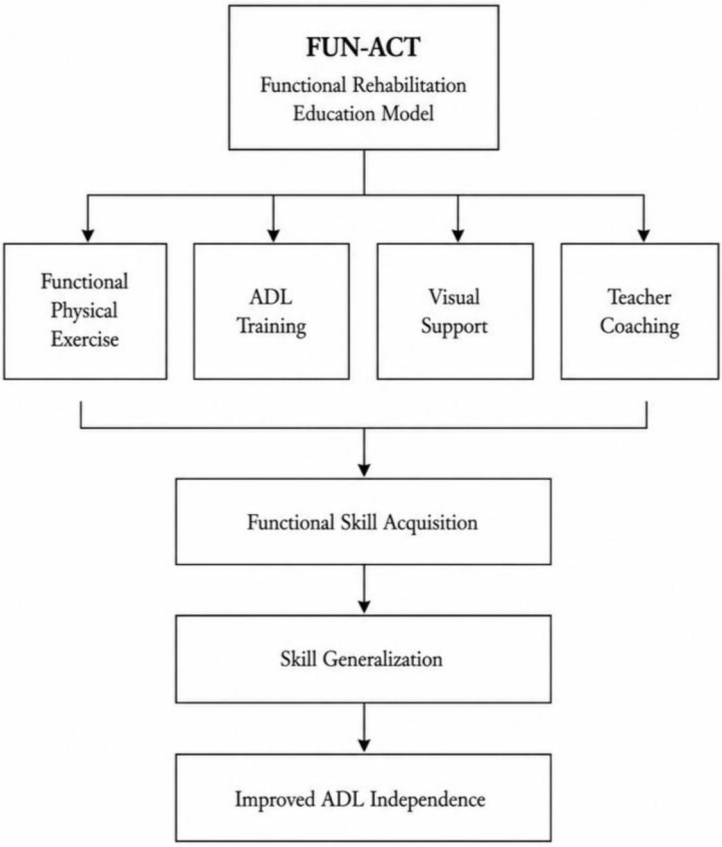


Fig. 1. Conceptual Framework of the FUN-ACT Functional Rehabilitation Education Model

2.4 Outcome Measures and Data Analysis

The primary outcomes of this study include the content validity, feasibility, practicality, and preliminary effects of the FUN-ACT functional rehabilitation education model on Activities of Daily Living (ADL) independence among children with Autism Spectrum Disorder (ASD). Content validity of the FUN-ACT model, implementation module, and ADL checklist will be evaluated by a panel consisting of pediatrician experienced in autism care and special education teachers experienced in working with children with ASD. The experts will assess the relevance, clarity, comprehensiveness, and practical applicability of each component using a structured content validation form. The ADL checklist, developed based on the functional skills addressed in the FUN-ACT module, will be administered before and after the intervention to evaluate changes in participants' functional independence.

Quantitative data will be analyzed using IBM SPSS Statistics version 31. Descriptive statistics will be used to summarize participant characteristics and expert validation results. The content validity of the model and assessment instrument will be determined using the Content Validity Index (CVI) [9]. Changes in ADL independence between pretest and posttest will be analyzed using appropriate paired statistical tests according to data distribution. Feasibility outcomes, including implementation practicality and participant adherence, will be summarized descriptively to provide preliminary evidence supporting future large-scale effectiveness studies [13].

2.5 Ethical Considerations

This study was conducted in accordance with the ethical principles of the Declaration of Helsinki and the International Ethical Guidelines for Health-related Research Involving Humans (CIOMS 2016). Ethical approval was obtained from the Research Ethics Committee of Universitas Negeri Malang under Ethical Approval No. 25.06.03/UN32.14.2.8/LT/2026 prior to study implementation. Written informed consent will be obtained from the parents or legal guardians of all participating children before enrollment. Informed consent will also be obtained from all expert validators and participating teachers involved in the study. Participant confidentiality will be protected by anonymizing all collected data, and participation will be entirely voluntary, with participants having the right to withdraw from the study at any time without any consequences.

3 Expected Outcome and Discussion

3.1 Expected Outcome

The FUN-ACT study is expected to produce a validated functional rehabilitation education model specifically designed to improve Activities of Daily Living (ADL) independence among children with Autism Spectrum Disorder (ASD). The anticipated outputs include a structured intervention model, an implementation module for teachers, and a validated ADL assessment checklist that can be integrated into routine classroom activities. Through expert validation and pilot feasibility testing, the study is expected to establish the practicality, acceptability, and feasibility of implementing the FUN-ACT model within special education settings, thereby providing a foundation for subsequent effectiveness evaluation studies [13].

The implementation of the FUN-ACT program is anticipated to contribute to improvements in children's functional independence, particularly in essential ADL skills such as self-feeding, dressing, personal hygiene, and activity transitions. The collaborative involvement of teachers and caregivers is expected to facilitate consistent practice and the generalization of functional skills across school and home environments, supporting more sustainable rehabilitation outcomes [15]. If demonstrated to be feasible, the findings of this study may provide preliminary evidence to support future large-scale effectiveness trials and the wider integration of

school-based functional rehabilitation interventions for children with ASD, particularly in resource-limited educational settings [9].

3.2 Discussion

Despite increasing evidence supporting rehabilitation interventions for children with Autism Spectrum Disorder (ASD), many existing programs remain therapist-dependent, focus on isolated developmental domains, or are delivered separately from routine educational activities. These limitations may reduce opportunities for repeated practice and hinder the transfer of acquired skills into children's everyday environments [17]. The FUN-ACT model was developed to address this gap by integrating functional rehabilitation principles into structured school routines through a multidisciplinary approach involving teachers and caregivers. This approach is consistent with recent guidance on the development of complex health interventions, which emphasizes stakeholder involvement, feasibility evaluation, and implementation within real-world settings before large-scale effectiveness testing [9].

The conceptual basis of FUN-ACT is founded on the integration of functional physical exercise, task-oriented ADL training, visual supports, and teacher coaching to facilitate functional skill acquisition in meaningful daily contexts. Rather than targeting isolated impairments, the model emphasizes repeated practice of everyday activities within children's natural learning environments, where motor, cognitive, and adaptive skills can be developed simultaneously [18]. Recent evidence suggests that structured educational rehabilitation approaches are more effective when individualized and combined with complementary interventions rather than implemented as stand-alone programs [19]. Similarly, school-based interventions provide repeated opportunities for practicing functional skills within authentic classroom routines, thereby supporting participation and long-term functional development.

Another important feature of the FUN-ACT model is the active collaboration between teachers and caregivers. Consistent implementation across school and home environments is expected to promote skill generalization, which remains one of the greatest challenges in autism rehabilitation [17]. Current evidence indicates that caregiver training and teacher-mediated interventions improve implementation consistency, caregiver competence, and children's functional participation when integrated into routine activities. Furthermore, strengthening collaboration between educational and family environments may enhance the sustainability of intervention outcomes beyond structured rehabilitation sessions.

If demonstrated to be feasible, the FUN-ACT model may provide a practical and scalable framework for integrating functional rehabilitation into routine special education practice, particularly in resource-limited settings where access to rehabilitation professionals remains limited. Beyond improving children's functional independence, the model has the potential to strengthen interdisciplinary collaboration among teachers, caregivers, and healthcare professionals, thereby promoting continuity of rehabilitation across school and home environments. Such an integrated approach may contribute to more sustainable rehabilitation services and inform future implementation strategies for school-based functional rehabilitation programs [9].

This study has several methodological strengths. First, the FUN-ACT program was developed using a systematic Research and Development approach that integrates evidence synthesis, needs assessment, expert validation, and pilot feasibility evaluation, thereby ensuring that the intervention is both evidence-informed and contextually relevant. Second, the model adopts a multidisciplinary perspective by combining functional rehabilitation principles with educational strategies within routine classroom activities, rather than delivering rehabilitation as a stand-alone clinical service. Third, the active involvement of teachers and caregivers is expected to promote implementation fidelity, facilitate the generalization of functional skills across school and home settings, and enhance the sustainability of the intervention in everyday practice. These characteristics may improve the practicality and scalability of the proposed model, particularly in educational environments with limited access to rehabilitation professionals

Several limitations should be considered when interpreting this study protocol. The pilot implementation will be conducted in a single special education school using a single-arm feasibility design without a control group, which may limit the generalizability of the findings and preclude conclusions regarding intervention effectiveness. In addition, the ADL assessment checklist developed for this study will undergo content validation but will not yet be comprehensively evaluated for psychometric properties such as construct validity and reliability. The relatively short implementation period may also limit the assessment of long-term maintenance and generalization of functional outcomes. Therefore, future studies should include multicenter randomized controlled trials with larger sample sizes, longer follow-up periods, and comprehensive psychometric evaluation of the assessment instrument to establish the effectiveness and broader applicability of the FUN-ACT model.

4 Conclusion

The FUN-ACT study protocol presents a systematic framework for developing and evaluating a school-based functional rehabilitation education model aimed at improving Activities of Daily Living (ADL) independence among children with Autism Spectrum Disorder (ASD). By integrating functional physical exercise, task-oriented ADL training, visual supports, and teacher–caregiver collaboration into routine classroom activities, the model is designed to bridge the gap between rehabilitation services and educational practice. Through expert validation and pilot feasibility evaluation, this study is expected to provide preliminary evidence regarding the practicality, acceptability, and feasibility of implementing the FUN-ACT model in special education settings. If demonstrated to be feasible, the findings may inform future large-scale effectiveness studies and support the integration of functional rehabilitation principles into school-based educational programs, particularly in resource-limited settings, to promote sustainable improvements in functional independence among children with ASD.

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