

OUTDOOR LEARNING AND AUTISM SPECTRUM DISORDER: COMPETENCES AND SUPPORTS FOR EFFECTIVE SKILL GENERALIZATION

APPRENDIMENTO ALL'APERTO E DISTURBO DELLO SPETTRO AUTISTICO: COMPETENZE E SUPPORTI PER UNA GENERALIZZAZIONE EFFICACE DELLE ABILITÀ



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ABSTRACT

Integrating the natural environment into the school curriculum represents an effective inclusive approach for students with Autism Spectrum Disorder, as it supports emotional regulation, attention, motivation, and experiential learning. Research shows that outdoor learning, video modeling, and augmented reality make natural experiences more accessible and meaningful (Cottini, 2022; Cottini et al., 2023). Outdoor activities also enhance social and communication skills (Tombolini & Langher, 2024) and align with ecological and hybrid instructional design (Zappalà, 2022). Supported by adequate teacher training and authentic assessment, these practices promote well-being, inclusion, and transformative educational experiences.

L'integrazione dell'ambiente naturale nel curriculum scolastico rappresenta un approccio inclusivo efficace per studenti con Disturbo dello Spettro Autistico, poiché favorisce regolazione emotiva, attenzione, motivazione e apprendimento esperienziale. Le ricerche mostrano che outdoor learning, video modeling e realtà aumentata rendono le esperienze naturali più accessibili e significative (Cottini, 2022; Cottini et al., 2023). Le attività all'aperto migliorano inoltre abilità sociali e comunicative (Tombolini & Langher, 2024) e si inseriscono in una progettazione didattica ecologica e ibrida (Zappalà, 2022). Sostenute da adeguata formazione docente e valutazione autentica, tali pratiche favoriscono benessere, inclusione e trasformazione educativa.

KEYWORDS

Analisi Comportamentale Applicata (ABA); Apprendimento all'aperto; Autismo (ASD); Generalizzazione delle competenze; Inclusione scolastica

Applied Behavior Analysis (ABA); Autism Spectrum Disorder (ASD); Outdoor Learning; School Inclusion; Skill Generalization

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Introduction

In recent decades, inclusive pedagogy has emphasized the need to design educational pathways capable of addressing the individual needs of students, with particular attention to those with Autism Spectrum Disorder (ASD). The integration of the natural environment into the school curriculum, known as outdoor learning, represents an innovative approach that fosters not only cognitive development but also socio-relational skills, emotional regulation, and intrinsic motivation (Sonnino et al., 2023).

This educational paradigm is based on principles of ecological design, according to which learning is not confined within classroom walls but takes place in varied and meaningful contexts, valuing direct experience and active student participation.

Recent studies have highlighted how outdoor activities can contribute to the development of functional play and social interactions in children with ASD. Specifically, Vignudelli, Artoni, and Cattalini (2023) demonstrated that peer-play training in natural contexts increases the quality and duration of social interactions, promoting the generalization of skills in contexts beyond the classroom. Similarly, Tombolini and Langher (2024) documented the effectiveness of “inside-outside” educational pathways, emphasizing how alternating between natural contexts and structured classroom spaces enhances a sense of belonging, participation, and autonomy in children diagnosed with autism.

Natural experiences also serve as a powerful tool for sensory modulation. Students with ASD often exhibit hypersensitivity to auditory, visual, or tactile stimuli typical of indoor environments. Outdoor learning, due to the predictability and controllability of natural stimuli, helps reduce sensory overload and supports attention and emotional self-regulation (Cottini, 2022). Moreover, integrating multimedia tools, such as video modeling or augmented reality, can further enhance the effectiveness of outdoor learning by providing visual supports and activity previews, reducing anxiety and uncertainty (Cottini et al., 2023).

Another key aspect concerns educational inclusion. Zappalà (2022) highlights the need for hybrid and ecological designs that make the natural environment a structural component of the curriculum. In this context, outdoor education is not an accessory addition but a strategy that combines disciplinary learning, socio-emotional development, and the enhancement of individual competencies, creating transformative experiences. Teacher training, the use of visual routines,

mediation tools, and authentic assessment systems are essential conditions for the sustainability and effectiveness of these pathways.

The objective of this study is to analyze effective teaching approaches that integrate the natural environment into the curriculum for students with ASD, highlighting operational principles, methodological strategies, and mediation tools. Additionally, it aims to synthesize recent empirical evidence and identify practical guidelines for designing inclusive, replicable, and sustainable outdoor pathways that promote experiential learning, participation, and educational transformation.

1. Analysis of needs

Applied Behavior Analysis (ABA) is widely regarded as one of the most empirically supported approaches for targeting adaptive, social, and communicative behaviors in children with Autism Spectrum Disorder (ASD). In Italy, as in many countries, the adoption of ABA in school contexts presents both opportunities and challenges, shaped by variables such as teacher training, resources, regulatory frameworks, and cultural acceptance.

A recent study published in *Behavioral Sciences* updates the evidence on how ABA interventions contribute to the improvement of social, communicative, and Theory of Mind abilities in children and adolescents with ASD. Esposito, Fadda, Ricciardi, Mirizzi, Mazza, and Valenti (2025,) conducted a systematic review showing that, when properly implemented, ABA has positive effects on these domains. Nevertheless, gaps remain regarding methodological rigor and the measurement of variables such as quality of life.

Another significant contribution comes from the study *The effectiveness of applied behavior analysis program training on enhancing autistic children's emotional-social skills* (2024, BioMed Central), which demonstrated that structured ABA-based training sessions can improve social, communicative, and daily living skills in institutionalized autistic children.

An Italian case study entitled *Functional Communication Training for Autism: An Italian Case Study* (Caracciolo et al., 2020) applied Functional Communication Training (FCT)—a procedure derived from ABA principles—to reduce problematic behaviors and improve communication in a four-year-old child with ASD. Findings included a significant reduction of dysfunctional behaviors, enhanced use of functional communication modes, and increased compliance with adult requests.

Although these studies are not necessarily conducted in traditional school settings, they provide valuable insights into how ABA can be adapted to educational and scholastic contexts.

A key element for the effective implementation of ABA in Italian schools is teacher training. Specialized courses and postgraduate programs, such as the Second Level Master's in Applied Behavior Analysis and Applications to Autism Spectrum Disorder promoted by ABA Italia and other institutions, represent an attempt to bridge the training gap among school professionals.

At the same time, teachers' perceptions, knowledge, and attitudes toward ASD and intervention strategies, including ABA, have been investigated. A national study on Italian teachers, Autism Spectrum Disorders and inclusion attitudes in the Italian school environments: teachers' knowledge, attitudes, perceptions and their necessity to consult a healthcare multidisciplinary team (Conte, Lupo, Mazzarella et al., 2022), highlights that while many teachers view inclusion as important, they report limited technical expertise and a lack of dedicated professional support in schools.

Taken together, these findings indicate that while ABA is a highly evidence-based approach, its integration into Italian schools requires structural investments in teacher training, interdisciplinary collaboration, and systematic efforts to ensure generalization of skills, including in outdoor learning environments.

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2. Specific limitations and challenges

Although case studies and research on ABA applied outside the classroom (home-based or clinical settings) exist, there remains a shortage of studies specifically within the school setting, particularly concerning the generalization of learning to outdoor contexts.

In the Italian context, ABA currently represents a promising evidence-based option for improving behavioral, social, and communication skills in children with ASD. However, its dissemination in schools is limited by several factors: the lack of school-based studies, variability in teacher training, insufficient resources, and diverse cultural attitudes. For ABA to become an established practice within schools, a concerted effort is required among researchers, educational institutions, policymakers, and practitioners.

Integrating the natural environment into the school curriculum represents a pedagogical strategy with high potential to promote curiosity, creativity, and experiential learning in students with Autism Spectrum Disorder (ASD). Outdoor learning offers multisensory spaces that allow modulation of stimuli, thereby fostering attention, emotional regulation, and motivation—areas that are often fragile in individuals with autism. This approach differs from traditional indoor methodologies in that it utilizes less structured contexts, yet ensures inclusivity through intentional design that recognizes and respects individual and sensory variability.

A key element is that the curriculum should not merely be “enriched” with outdoor experiences; rather, the natural environment should become an integral component of didactic planning. This implies that activities such as guided explorations, outdoor sensory workshops, artistic experiences in nature, and environmental observations should become means for building disciplinary knowledge (science, art, geography), as well as transversal competences such as autonomy, social interaction, and personal initiative. The principle of “multiple means” of representation, action, and expression, derived from frameworks such as Universal Design for Learning, is fully applicable in these contexts.

Recent Italian scholarship provides relevant contributions. Zappalà (2022), in *Ambienti di apprendimento ibridi per l’inclusione degli allievi con ASD: Verso una progettazione ecologica*, argues that hybrid learning environments (in-person, distance, outdoor) can be designed from an ecological perspective that values the entire educational community, incorporating natural and non-school contexts as co-essential components of learning. Similarly, Cottini (2022), in *L’allievo con autismo a scuola. Percorsi per l’inclusione*, underscores that adapting contexts and removing barriers to learning are indispensable for constructing pathways that foster participation, meaningful learning, and authentic inclusion.

For individuals with ASD, interaction with nature can help reduce anxiety and sensory overstimulation, offering stimuli that are more predictable and controllable, which can be activated or deactivated according to individual needs. Essential supports include visual tools, routines, anticipations, and media resources such as video modeling or multimedia activities, which prepare students for outdoor experiences and consolidate learning. Some experimental studies (Cottini et al., 2023) on video modeling and augmented reality applied in natural contexts have demonstrated increases in autonomous participation and motivation among students.

The social dimension of outdoor learning deserves special attention: collaborative activities in nature foster authentic interactions, peer relationships, cooperation, and dialogue. Since these situations are less constrained by formal modes of evaluation and performance, they allow for creative expression and experimentation, supporting students' perception of themselves as active agents in transformative learning.

From a methodological standpoint, effective approaches share several operational principles:

- (a) inclusive design from the outset, taking into account individual differences in sensory, relational, and cognitive needs;
- (b) flexible structuring of time and space, with personalized rhythms and sensory breaks;
- (c) visual and multimedia supports to anticipate and reflect on outdoor activities;
- (d) authentic assessment based on naturalistic observations, portfolios, and self-/sensory narratives;
- (e) specialized teacher training in special education, sensory needs management, and experiential methodologies.

Recent empirical evidence includes studies such as school in-out continuum: Clinical experiences with children with autism in outdoor education settings (Tombolini & Langher, 2024), which document how concrete outdoor experiences can promote not only specific knowledge but also a sense of belonging, exploration, and personal growth in natural contexts. Similarly, *Autismo: un approccio ecologico* (Sonnino et al., 2023) emphasizes that contact with nature strengthens the concepts of biodiversity and neurodiversity, proposing that experiencing nature should become an educational practice that embraces individual identity.

3. How to Implement a Learning Generalization Intervention in Outdoor School Settings

To effectively implement an intervention aimed at generalizing learning in outdoor contexts, it is essential to start with a thorough assessment of the skills already acquired by students in indoor settings, identifying the target goals to be transferred to the natural environment, such as communication, social skills, and personal autonomy (Esposito, Fadda, Ricciardi, Mirizzi, Mazza, & Valenti, 2025). Instructional design should integrate outdoor learning into the school curriculum, ensuring that outdoor activities are not considered mere enrichment, but become

an integral part of the educational program through an indoor–outdoor continuum (Tombolini & Langher, 2024).

Activities should include variations in context, materials, people, and tasks to facilitate the transfer of skills and flexibility in applying learned abilities (Morsanuto, Peluso Cassese, Tafuri, & Martone, 2023).

Students with Autism Spectrum Disorder (ASD) require specific supports to ensure participation and reduce sensory overload: visual routines, multimedia previews, video modeling, and multisensory activities promote understanding and motivation (Cottini et al., 2023). It is equally important to provide safe spaces for sensory breaks and self-regulation, integrating outdoor learning with individualized scaffolding strategies.

The social dimension must be considered in the design: collaborative activities in nature foster authentic peer interactions, cooperation, and dialogue, offering contexts less constrained by formal assessment methods and allowing creative expression and transformative learning (Sonnino, Pellegatta, & Rumiati, 2023).

Finally, specialized teacher training, flexible structuring of time and space, and authentic assessment based on naturalistic observations and portfolios ensure the sustainability and effectiveness of the intervention, promoting the generalization of skills across multiple outdoor contexts and consolidating adaptive, social, and emotional competencies (Bettoni, Addabbo, Ghidina, Turati, & Vagni, 2023; Caracciolo, Esposito, Dipierro, Martella, & Smith, 2020).

The combination of ABA and outdoor learning presents significant potential for generalizing skills, providing varied and meaningful contexts in which social, communicative, and adaptive abilities can be transferred. However, Italian literature highlights a limited diffusion of studies systematically combining ABA with outdoor interventions in school settings, with most research focusing on clinical or home-based contexts (Cottini et al., 2023). Therefore, this narrative review aims to synthesize recent evidence from 2020 onwards, highlighting operational strategies for designing school-based interventions that promote skill generalization in outdoor contexts for students with ASD.

4. Narrative Review

In recent years, the need for inclusive and personalized educational pathways has become central in the Italian school system, with particular attention to students with Autism Spectrum Disorder (ASD) (Cottini, 2022; Zappalà, 2022). Applied

Behavior Analysis (ABA) is recognized as one of the most empirically supported approaches for improving social, communicative, and adaptive skills in children with ASD (Esposito, Fadda, Ricciardi, Mirizzi, Mazza, & Valenti, 2025; Caracciolo, Esposito, Dipierro, Martella, & Smith, 2020). Concurrently, integrating natural environments into the school curriculum—known as outdoor learning—has been shown to enhance attention, emotional regulation, creativity, and experiential learning, particularly for students with sensory vulnerabilities typical of ASD (Sonnino, Pellegatta, & Rumiati, 2023; Tombolini & Langher, 2024).

This is a narrative review with an operational focus, aimed at providing practical guidance for the application of ABA in school-based outdoor settings. Studies were selected based on relevance and recency:

- Publication period: 2020–2025.
- Population: children and adolescents diagnosed with ASD.
- Intervention setting: educational or school contexts, with particular emphasis on outdoor experiences or skill generalization.
- Publication type: peer-reviewed articles, case studies, narrative reviews, or clinical-educational trials.

The literature search was conducted in international databases such as , Scopus, and Google scholar, using combined keywords including “Applied Behavior Analysis,” “Autism Spectrum Disorder,” “school-based intervention,” “outdoor learning,” and “generalization of skills.” Selected studies were synthesized to highlight:

- (a) operational strategies for skill generalization,
- (b) instructional tools and supports,
- (c) observable outcomes in naturalistic contexts, and
- (d) implications for school-based instructional design.

The method does not constitute a systematic review but a targeted narrative review, as the primary aim is to provide practical guidelines and operational recommendations for teachers and school practitioners, rather than to comprehensively summarize all available literature.

4.1. Operational strategies for generalizing learning in outdoor contexts for students with ASD (table 1)

Phase/Objective	Operational strategies	Tools and supports	Evidence/Authors
Assessment and goal definition	Analysis of skills acquired in indoor settings; selection of target goals for generalization	Structured observations, functional assessment sheets	Esposito et al., 2025
Inclusive planning	Integrate outdoor activities into the curriculum as a core component; ensure continuity between indoor and outdoor contexts	Integrated lesson plans, maps of educational pathways	Tombolini & Langher, 2024
Context and material variation	Apply the same skill in different outdoor spaces; use diverse natural materials	Garden, courtyard, park, natural materials (leaves, stones, water)	Morsanuto et al., 2023
Scaffolding and supports	Provide anticipatory cues and visual mediators; use video modeling and multisensory routines; schedule sensory breaks	Visual cards, tablets, video modeling, quiet spaces	Cottini et al., 2023
Promotion of social interaction	Collaborative activities in nature, group games,	Cooperative games, sensory workshops, artistic experiences	Sonnino et al., 2023

	guided explorations		
Monitoring and evaluation	Naturalistic observations, portfolios, self-assessments; record frequency, quality, and transfer of skills	Observation grids, video recordings, digital portfolios	Bettoni et al., 2023; Caracciolo et al., 2020

The analysis of literature from 2020 to the present highlights that the implementation of ABA interventions in school-based outdoor settings can promote the generalization of social, communicative, and adaptive skills in children with ASD. Although most studies are still experimental or case-study in nature, several common operational principles and effective tools have emerged, summarized in Table 1.

Assessment and goal definition: The selection of skills to generalize should begin with an analysis of competencies acquired in indoor settings, taking into account both behavioral objectives and individual needs (Esposito et al., 2025).

Inclusive planning: The integration of outdoor learning into the curriculum should be planned as a structural component, creating continuity between traditional school spaces and natural environments, with personalized lesson plans (Tombolini & Langher, 2024).

Context and material variation: Exposing students to the same skills in different spaces and with diverse natural materials fosters behavioral flexibility and skill generalization (Morsanuto et al., 2023).

Supports and scaffolding: The use of visual aids, multisensory routines, and video modeling prepares students for outdoor experiences, reducing anxiety and sensory overload while promoting autonomy (Cottini et al., 2023).

Promotion of social interaction: Collaborative activities in nature, such as group games and sensory workshops, facilitate authentic peer relationships, cooperation, and active participation (Sonnino et al., 2023).

Assessment and monitoring: Naturalistic observations, portfolios, and video recordings allow monitoring of skill transfer and the sustainability of learning in outdoor contexts (Bettoni et al., 2023; Caracciolo et al., 2020).

Selected studies show that structured ABA experiences integrated into outdoor contexts can enhance motivation, autonomy, and active participation of children with ASD, promoting both disciplinary learning and transversal skills (Sonnino et al., 2023; Tombolini & Langher, 2024). Although the evidence is promising, limitations remain due to small sample sizes, methodological variability, and a lack of longitudinal studies.

In summary, the review indicates that an intervention aimed at the generalization of learning in outdoor school-based settings should combine inclusive planning, mediating tools, context variation, and continuous assessment to ensure experiential and transformative learning for students with ASD.

Table 1 summarizes the main operational strategies emerging from recent literature.

5. Discussion and conclusions

The review of recent literature clearly indicates that the implementation of Applied Behavior Analysis (ABA) interventions in school-based outdoor settings represents an effective strategy for promoting skill generalization in children with Autism Spectrum Disorder (ASD). Utilizing natural environments as educational contexts allows the integration of disciplinary learning with the development of social, communicative, and adaptive skills, while simultaneously enhancing motivation, autonomy, and active participation.

From a methodological perspective, several key principles emerge: (a) inclusive planning from the outset, considering individual sensory, relational, and cognitive differences; (b) controlled variation of contexts, materials, and social partners to facilitate behavioral flexibility; (c) the use of mediating tools such as visual routines, video modeling, and multisensory activities; and (d) authentic assessment based on naturalistic observations, portfolios, and video documentation. When combined, these elements contribute to experiential and transformative learning experiences that can be replicated across multiple outdoor contexts (Cottini et al., 2023; Sonnino et al., 2023; Tombolini & Langher, 2024).

Despite these promising outcomes, the review highlights significant limitations and challenges: most studies involve small samples, there is marked methodological heterogeneity, and few investigations have been conducted in Italian school contexts, with limited longitudinal data. Moreover, the dissemination of ABA

outdoor interventions requires specialized teacher training, adequate resources, and coordinated efforts among schools, families, and institutions.

In practical terms, the evidence suggests that outdoor learning should not be considered optional enrichment, but rather an integral component of the curriculum, with activities that combine disciplinary learning and the development of transversal skills. Collaborative activities, sensory workshops, guided explorations, and environmental observations become tools for constructing meaning, promoting participation, and supporting emotional regulation in children with ASD.

In conclusion, the integration of ABA and outdoor learning offers an inclusive and replicable educational model capable of promoting social, emotional, and cognitive skills in a sustainable manner. To consolidate these practices within the Italian school system, it is essential to develop evidence-based operational guidelines, teacher training programs, and longitudinal studies documenting the effectiveness and sustainability of interventions. This approach provides a concrete pathway to transform the educational experiences of students with ASD, fostering meaningful learning, active participation, and holistic development in natural contexts.

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