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Universal Design for Learning in Forest Education: A Conceptual Analysis

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ABSTRACT

Universal Design for Learning (UDL) is currently one of the key frameworks supporting inclusive education, emphasising the need to design flexible learning environments and to reduce barriers that limit access to knowledge. At the same time, there is growing interest in forest education as a specific form of outdoor education grounded in direct contact with nature, experiential learning, and the strengthening of learners' agency and autonomy. Despite clear conceptual overlaps between UDL and practices used in forest education, the relationships between these two approaches remain only partially explored in the literature. The aim of this article is to offer a conceptual analysis that identifies potential areas of integration between UDL principles and forest education practices. The paper discusses the theoretical foundations of UDL and the core assumptions of forest education, highlighting shared elements such as multisensory experience, learner agency, diversity of available forms of activity, flexibility of the learning environment, and the possibility of adapting activities to individual learner needs. On this basis, key components are identified that may inspire the design of accessible, engaging, and varied learning environments aligned with the principles of Universal Design for Learning.

KEYWORDS: Universal Design for Learning (UDL), inclusive education, forest education, learning environment design

Introduction

Contemporary education faces the challenge of designing learning environments that are accessible, flexible and adequate to the diverse needs of students. Universal Design

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for Learning (UDL) is one of the key educational frameworks supporting inclusive education, offering the concept of planning didactics that take into account the natural diversity of learners. At the same time, Forest School, based on experience, exploration and learner autonomy, is gaining popularity as an important part of the broader outdoor education tradition. So far, the interrelationships between these two approaches have only been analysed fragmentarily, even though there are many indications of their mutual complementarity. The aim of this article is to identify theoretical areas of synergy between Universal Design for Learning and forest school and to propose directions for further research into the possibility of integrating these two perspectives. This text constitutes a conceptual analysis. The cited empirical research—such as Murray & O'Brien (2005) or Waite, Břilling & Bentsen (2016)—serve an illustrative function in this paper and only serve to show the broader theoretical context of forest school. The article does not constitute a systematic synthesis of research findings, but identifies areas of potential synergy between Universal Design for Learning and forest education and points to directions for further analysis and empirical research.

Universal Design for Learning (UDL)

Modern education systems increasingly emphasise the need to ensure both equal and full participation of all learners, regardless of their differing needs and abilities. Responding to the need to ensure equitable access to education for all learners, including those with diverse developmental, medical and social needs, the concept of Universal Design (UD) and, within its field, a more specific variation: the Universal Design for Learning (UDL), developed by the Centre for Applied Special Technology (CAST), emerged. This concept was inspired by cognitive neuroscience research, which clearly indicates that variability is a dominant feature of the nervous system and that people differ in the ways they perceive and process information, engage and express their knowledge (CAST, 2018, p. 1). UDL is therefore a framework for curriculum and learning design that aims to plan and structure the learning environment in such a way as to ensure equitable access for all participants (Perkowska & Bajkowski, 2022). Universal Design for Learning thus assumes that variability is not the exception but the norm, and that educational barriers are primarily due to the design of the environment, not to student characteristics. In educational terms, this means creating an environment not only physically but also socially and culturally that enables safe, comfortable and full participation in learning processes.

The neuropsychological basis of Universal Design for Learning describes three functional brain networks: cognitive, responsible for: *what we learn*; strategic, responsible for: *how we learn*; and affective, responsible for: *why we engage in the process*

(Meyer & Rose, 2002, p. 21). These networks are responsible, in turn, for the perception and interpretation of information, the planning and execution of activities, and the motivation and affective regulation of engagement. As interpreted by Chamblin (2017), three categories of didactic decisions correspond to them: the selection of forms of content presentation, the organisation of information processing, and the determination of products that constitute evidence of learning. Each of these elements should be designed with the diverse capabilities of the students in mind.

The CAST guidelines (2011) therefore identify three main areas of instructional design:

- **Multiple Means of Representation—what are we learning?**—a principle relating to how learners receive and interpret information. It includes diverse forms of content presentation (visual, auditory, kinaesthetic, symbolic) so as to reduce cognitive and sensory barriers;
- **Multiple Means of Action and Expression—how do we learn?**—refer to how learners plan, organise and present their learning. Include different ways of responding, performing tasks, communicating progress (e.g. art, multimedia presentations, digital recordings);
- **Multiple ways of engaging learners—why do we learn?**—relate to why learners engage in the learning process. This principle encompasses motivational strategies, choices, autonomy, emotion regulation and maintenance of effort and perseverance (Israel et al., 2014).

The link between Universal Design for Learning and the three brain networks model, pointed out by Edyburn (2010) among others, justifies the need to design didactics in a flexible and multidimensional way, one that corresponds to the diverse cognitive and motivational profiles of learners. UDL shifts the focus from post-hoc accommodations to proactive design that takes learner variability into account from the very beginning. These three principles develop into more detailed guidelines and checkpoints that provide practical guidance for the design of the learning environment (CAST, 2011). These checkpoints include, but are not limited to: adjusting the method of presentation of information, supporting goal setting and planning and development of learning strategies, enhancing autonomy and authenticity, facilitating coping strategies and emotion regulation, supporting student self-assessment and reflection, etc. (CAST 2011, cited in Israel et al., 2014). They enable teachers to minimise environmental barriers and create more accessible, balanced and engaging learning environments that are conducive to all students, regardless of their styles, needs or neuropsychological profiles. This is particularly important in socially and culturally diverse learning

environments, as well as in those educational contexts that rely on flexible and varied forms of action, such as outdoor education.

Forest School—key principles

Forest School is an educational approach based on long-term, regular contact between children and the natural environment—usually a forest. Its aim is to foster holistic development through experience, free exploration, play and tasks performed in the natural environment. As Susan Isaacs, promoter of free activity in child development, emphasised, “*Children must be given freedom to explore the world in their own way*” (Isaacs, 1929, p. 37).

The roots of education in nature go back to the wider heritage of European and British pedagogical thought, developed by philosophers, naturalists, physicians and educators such as Johann Heinrich Pestalozzi, Rudolf Steiner, John Ruskin, Kurt Hahn, Robert Baden-Powell, Leslie Paul, Susan Isaacs, Maria Montessori or sisters Rachel and Margaret Macmillan. These creators emphasised the importance of direct contact with nature for child development (Cree & McCree, 2012). As Knight points out ‘The concept of Forest School in Britain was strongly influenced by Scandinavian forest kindergartens, but is also embedded in a broader European tradition of outdoor learning’ (Knight, 2013, p. 5).

The 1950s are considered to be the proper beginning of modern Forest Education, when the first forest kindergartens were established in Scandinavia, promoting learning through exploration of the natural environment. Forest School, although as an idea and programme for early childhood education it was initially only just taking shape, has developed rapidly in Scandinavian countries, benefiting from the popularity of outdoor activities (*friluftsliv*), social changes and growing environmental awareness. In the 1970s and 1980s, the model was particularly deeply rooted in Denmark, Norway and Sweden, gradually penetrating further European countries.

In 1993, a group of nursery *nurses* from Bridgwater College in Somerset visited Denmark to learn about the early childhood education system there. When they returned, inspired by Scandinavian pedagogy based on constant outdoor activities, free play and a child-centred approach, they launched their own Forest School program in a nursery operating at the college. In 1995, Bridgwater College developed the BTech Forest School qualification for practitioners working in early childhood education. At the beginning of the 20th century, other countries—including Wales and England—have started to implement the model. In 2003, the Open College Network (OCN) qualification was established through the collaboration of trainers from England and Wales and the support of Forestry Commission Wales, significantly accelerating

the development of Forest School across the country (Cree & McCree, 2012). In 2002, the network of practitioners organised the first national conference, during which the British definition of Forest School was formulated, describing it as

An inspirational process that offers children, young people and adults alike regular opportunities to achieve, develop confidence and self-esteem through hands-on learning experiences in a local woodland environment (Forest School Association, 2002).

The Forest School Association points to six principles that characterise the Forest School:

1. **A long-term process**, involving regular sessions rather than one-off or occasional visits; an observation-planning-evaluation cycle.
2. **Takes place in a forest or natural environment**
3. **A child-centred process** (agency, exploration, autonomy) creating a community of being, development and learning.
4. **Supporting the holistic development of all participants**, fostering resilience, confidence, self-reliance and creativity.
5. **It offers supported risk-taking**, appropriate to the learner's environment and capabilities.
6. **Led by qualified Forest School practitioners** (Dabaja, 2022, p. 641–642).

In recent decades, Forest School has been dynamically expanding, adopting a variety of local variants and becoming one of the key trends in contemporary outdoor education. As Knight notes, "Forest School practice is not simply exported in its original form; it evolves within the cultural, social and environmental context of each country" (Knight, 2013, p. 18).

Conceptual Intersection of Universal Design for Learning (UDL) and Forest Education

Research on forest education has consistently shown that its impact on children's development is multidimensional and difficult to capture within traditional educational categories. One of the first studies to systematically document these impacts was a report prepared by Murray and O'Brien (2005). The authors conducted a long-term study of Forest School in England, including three in-depth case studies from the Worcestershire, Shropshire and Oxfordshire regions, enhanced by additional observations from practices in Somerset. The authors' report identifies a total of six

main categories representing the key impacts of Forest School on the participating children. Studies have indicated that regular activities in the natural environment lead simultaneously to: (1) increased self-confidence, (2) improved social skills, (3) language development, (4) greater motivation to learn and improved concentration, as well as greater (5) physical fitness and (6) deeper understanding of the natural world (Murray and O'Brien 2005).

Complementing the above research, the analysis by Waite, Brilling and Bentsen (2016; as cited in Dabaja, 2022), is conceptual and comparative and covers a broader, international context, juxtaposing the literature on the Forest School in England with the Danish *udeskole* model. The authors corroborate many of the findings of the report Murray & O'Brien, pointing to the same development categories, but putting them in a broader systemic and cultural perspective. Researchers emphasise, among other things, the importance of learner autonomy, long-term participation and rooting practices in the local environment (2016; as cited in Dabaja, 2022). A systematic review of research on Forest School by Dabaja (2022), synthesises the findings of the Murray and O'Brien (2005) report and the Waite, Brilling & Bentsen (2016) analysis, and organises the earlier categories into seven key themes: (1) social and cooperative skills, (2) physical skills, (3) self-confidence and self-esteem, (4) educational attainment and cognitive skills, (5) emotional and psychological well-being, (6) environmental awareness and sense of belonging, and (7) risk management skills. Thus, this review not only confirms the Forest School effects most commonly described in the literature, but also extends previous typologies to include the distinct area of emotional well-being and risk management as distinct, relevant dimensions of children's experiences in forest education settings (Dabaja, 2022, p. 647),

This juxtaposition of two perspectives—empirical and conceptual—indicates that outdoor education works primarily through mechanisms that support children's natural learning strategies: choice, action, social relationships, sensory experience and the opportunity to express themselves in multiple ways.

In order to answer the question of how forest education can fit into the framework of Universal Design for Learning, a comparative analysis was conducted based on the key principles of both approaches. The juxtaposition is not about outcomes, but about the processes and conditions of learning that are constitutive of UDL (Multiple Means of Engagement, Representation and Action & Expression) and the six Forest School principles. The table presents the relationship between the specific principles of the two approaches, rather than between the development categories. Interpretive caution has been exercised, limiting itself to areas of compatibility arising directly from the theoretical framework rather than from reported impact effects.

Table 1. Links between the principles of Universal Design for Learning (UDL) and Forest Education

Forest School (FS) principle	The principle of Universal Design for Learning (UDL)	Justification (processes and reduction of barriers)
FS1. Regular, long-term process	Multiple Means of Engagement	Regularity and predictability support self-regulation (stabilises emotions, lowers cognitive load), facilitate sustained effort and build lasting commitment.
FS2. Takes place in a natural environment	Multiple Means of Representation	The natural environment provides diverse perceptual modalities (vision, hearing, touch, proprioception), which reduces sensory barriers and promotes the integration of information.
FS3. Child-centred process (autonomy, agency, exploration)	Multiple Means of Engagement	The ability to choose and direct an activity increases intrinsic motivation and develops behavioural self-regulation (planning, initiating, monitoring one's own activities).
FS4. Holistic development	Multiple Means of Action & Expression	Manipulation of natural materials, movement and construction enable a variety of forms of expression and action planning, enhancing cognitive self-regulation and executive functions.
FS5. Supported risk-taking	Multiple Means of Action & Expression	Risk assessment and anticipation of consequences develop executive functions (inhibition, planning, sequencing), key in Action & Expression and in self-regulation.
FS6. Skilled, responsive FS leaders	Multiple Means of Engagement	Relational support from an adult reduces stress, strengthens the sense of competence and enables the transition from support to self-reliance, which promotes emotional self-regulation

Source: own elaboration based on Murray and O'Brien (2005) and Dabaja (2022)

The table shows the links between the Forest School principles and the Universal Design for Learning framework at the level of learning processes rather than educational outcomes. The analysis considers only those elements described under both approaches-reduction of barriers, multi-sensory representation, differentiated forms of action and components of self-regulation. The juxtaposition does not assume structural equivalence of the models, but indicates areas of functional compatibility where the environmental and pedagogical characteristics of forest education correspond to the assumptions of universal design. This approach shows the complementarity of approaches while maintaining their theoretical distinctiveness.

Universal Design for Learning (UDL) in the light of research —possibilities and limitations in view of application in forestry education

Universal Design for Learning is based on a solid theoretical foundation and is widely recognised as an approach that supports inclusion. However, as the literature indicates, the model still requires conceptual clarification, standardised implementation procedures and sound empirical research—especially in areas of education that operate outside the traditional school classroom.

One of the first researchers to critically analyse Universal Design for Learning was Edyburn (2010), who drew attention to the lack of a precise, operational definition of the model. He emphasised that there is no clear consensus on how UDL should be interpreted and implemented, making it difficult to both assess the fidelity of implementation and to test its actual effectiveness.

Similarly, King-Sears (2014) points out in her work that, despite the growing interest in universal design in education, empirical evidence of its effectiveness (particularly for students with specific learning disabilities) is ‘severely limited’ (King-Sears, 2014, p.69). Al-Azawei, Serenelli & Lundqvist’s (2016) analysis shows that while most studies report positive effects of Universal Design for Learning implementations, their varying operationalisations and uneven methodological quality make it significantly difficult to compare results. The authors stress the need for further research to confirm the reliability of the model. Capp (2017) points to similar conclusions in presenting the positive effects of UDL, while accentuating important methodological shortcomings, such as the inconsistency of the operationalisation of the three principles.

A new Universal Design for Learning publication, Catam’s Narrative Review (2025), covering the period 2014–2024, confirms that this model can foster increased student motivation and engagement, but that effectiveness depends heavily on teacher preparation, school resources and wider institutional support. The author also emphasises the need for longitudinal and context-sensitive research to better understand under which conditions UDL actually delivers the expected results.

Despite the limitations indicated in the literature regarding the implementation of the Universal Design for Learning model and the lack of clear empirical evidence of its effectiveness, it still remains a valuable framework for designing accessible and flexible education, especially in environments based on various forms of activity, such as forest education. However, the implementation of UDL in the field of informal and outdoor education is still poorly recognised, which marks a significant research gap. At the same time, it is outdoor education, through its inherent diversity of learning modes and flexibility of action, that provides a particularly promising context for the application of universal design principles.

At the same time, there is an indication in the literature of the risk that the Forest School—with its increasing popularity and institutionalisation—may become reified and become a simplistic set of practices detached from its cultural and theoretical underpinnings (Leather, 2018). The author identifies three key problems: cultural and historical conditions that make the approach difficult to transfer to other contexts, insufficient theoretical development of pedagogy—especially concerning the role of play—and increasing commercialisation leading to shallow, superficial practice. In doing so, it emphasises the need for robust research to distinguish Forest School's real values from marketing narratives (Leather, 2018).

Imposing Universal Design for Learning principles on outdoor environments further demonstrates many operational challenges: the natural variability, spontaneity and openness of the learning process make it difficult to accurately plan, document and assess the fidelity of model implementation. In approaches such as forest education, where activities are dynamically adapted to the weather, the mood of the group or unpredictable events in nature, the implementation of UDL requires extremely flexible tools and a clear quality framework. Meanwhile, forest education operates largely outside the formal structures of the education system, resulting in a lack of standardised standards, working protocols and evaluation tools. Therefore, in-depth, interdisciplinary research on how UDL can be reliably and comparatively implemented in the natural environment is needed to avoid simplifications and to fully realise the development potential of the Forest School.

Conclusions

The analysis carried out in the article shows that Universal Design for Learning and forestry education have many points of contact, especially in the areas of the flexibility of the learning process, the multi-sensory nature of the experience and the enhancement of learner autonomy. Combining the two approaches opens up the promising prospect of designing learning environments that are at once accessible, engaging and naturally diverse, and thus better able to meet the contemporary needs of inclusive education. From a practical perspective, Universal Design for Learning can be a valuable tool to support forestry education in planning, documenting and diagnosing learning processes more systematically, without compromising its dynamic, experiential nature. At the same time, outdoor education brings to UDL a context that is uniquely conducive to the model's aims—as it offers a wealth of natural forms of activity, freedom of exploration and multi-sensory ways of engaging students that are difficult to achieve in a traditional classroom.

However, despite the indicated similarities, it is necessary to clearly highlight the boundaries of the two models. Forest School is based on an emergent philosophy, rooted in constructionism and responsive following of students' activities and interests. Universal Design for Learning, on the other hand, implies a greater degree of predictability, structure and planning based on predetermined checkpoints. This means that full integration of the two approaches requires an awareness of the discrepancy between the spontaneity and situational nature of the learning process and the need for systematic design and evaluation of implementation fidelity. Recognising these differences allows for a more precise identification of both the opportunities and the limitations of synergies between Universal Design for Learning and forestry education.

Outdoor education—especially forest education—is based on spontaneity, emergent curriculum and a flexible response to changing environmental conditions and group needs. Excessive use of Universal Design for Learning rules could lead to unintended formalisation of practices that, by definition, derive their value from openness, unpredictability and situationality. Thus, there is a risk that the key values of forestry education will be undermined if the pursuit of compliance with the UDL model becomes overridden by its original pedagogical objectives.

It is therefore necessary to seek a balance between flexibility and structure—an approach that will harness the potential of Universal Design for Learning to reduce barriers and enhance accessibility, while maintaining the spontaneous, experiential and environmentally rooted nature of forest education. Reflection on this discrepancy should become an important area of further theoretical and practical debate on the possibility of integrating both models. In view of the paucity of empirical research on the application of UDL outside the school environment, this article takes a conceptual form and uses the theoretical underpinnings of the model to identify potentially relevant directions for outdoor pedagogy. This approach enables the preliminary identification of areas requiring further exploration and the identification of challenges and opportunities resulting from the integration of both currents. Research recommendations include the need for longitudinal, context-sensitive and applied research, including, in particular, research on the application of Universal Design for Learning in forest education with students with special educational needs. Such studies will not only verify the effectiveness of the proposed solutions, but also clarify how UDL can support the development of accessible and inclusive outdoor education practices. However, these conclusions remain provisional and require further empirical validation in context-specific Forest School settings.

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