Chapter 5
How Education Can Be Leveraged to Foster Adolescents' Nature Connection

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5.1 Introduction

Our aim in this chapter is to present an overview of the importance of nature connection for adolescents (12–18 year olds). This target group is a well-considered choice since the interest in nature dips in adolescence (e.g., Olsson & Gericke, 2016; Krettenauer et al., 2020). In this chapter, we bring together key insights from different disciplines on the relevance of nature connection in adolescence, in particular from the health- and education sciences perspectives. First, we will clarify the terminology used in this chapter: we will define our use on the concepts 'nature connection' and 'outdoor environmental education' and establish the association between them. What follows is an overview of the importance of nature for adolescents and the prominent role education can play in fostering nature connection in this target group. We will also show that despite the many advantages, several thresholds and levers can be identified in the literature for working on nature connection with adolescents, especially during secondary education. Subsequently, we zoom in on the practical experiences and the obstacles that we identify at

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adolescent, teacher, and school level. We end the chapter with practical recommendations for the actors involved to promote nature connection in secondary education.

> *We abuse land because we regard it as a commodity belonging to us. When we see land as a community to which we belong, we may begin to use it with love and respect. (Leopold, 1949).*

The relevance of feeling connected to nature is a prominent subject in the works of ecologists and ecopsychologists (Mayer & Frantz, 2004). In line with Kleespies and Dierkes (2020) we distinguish two dimensions within the concept of nature connection. On the one hand, the emotional and psychological relationship of an individual to nature, where nature can be seen as part of ourselves. On the other hand, the behavioral dimension: taking care of nature. Consistent with Mayer and Frantz (2004), we pose that if people feel part of the wider natural world, they are more likely to address environmental issues effectively. Consequently, nature connection is an essential part of promoting pro-environmental behaviour.

Outdoor environmental education (OEE), as defined in this book, is any environmental and sustainability education (ESE) program intentionally using the outdoor (both natural and urban) environment as the main source of learning related to ESE-aims. We focus on various forms of OEE in this chapter, including residential programs, community-based programs, inquiry-based learning programs in the natural environment, as all these programs have the potential to affect nature connection in adolescents (Bergman, 2016).

The importance of nature connection for the development of adolescents is repeatedly emphasized in scientific literature. Both for health, wellbeing, and school performance, as well as building the fundaments for a sustainable, pro-environmental attitude as a citizen (Barrable & Booth, 2020). Learning in and about nature holds great potential for stimulating nature connection among adolescents. It can contribute to long-term and intrinsic motivation among citizens to take up a commitment to protect and conserve (local) nature. On the other hand, nature can also have disadvantageous impacts on the health of adolescents such as physical discomfort and anxiety.

Because of the health and educational benefits, OEE is receiving more and more attention, also when it comes to health inequality: unequal access to or proximity to green space in the residential or learning environment can contribute to health inequality. Additionally, many studies have shown that informal nature experiences and experiences in natural environments during adolescence are consistently regarded as the most important formative experience and lay a foundation for environmentalism (Clayton et al., 2019). Nature connection seems to be a key element and the educational system lend itself well to deploying this concept democratically among all students. Our argument is therefore that leveraging education to foster nature connection makes an important contribution to counteracting health inequalities among adolescents.

5.2 Importance and Relevance of Nature Connection for Adolescents

Recently, Marselle et al. (2021) presented a model that helps to categorize the many effects nature connection can have on adolescents. We use their model to discuss these effects specifically for the target group of our current chapter, adolescents, on:

1. health,
2. school performance,
3. environmental citizenship.

The life stage of adolescents is characterized as a challenging period with many changes at the cognitive, social, emotional and physical level. It is a pivotal time in identity development and a period associated with high levels of stress. The latter is exactly why the impact of nature is even more relevant for this target group. Finally, the school – a place where adolescents spend a lot of time – is an important context where this development can be facilitated and supported (Verhoeven et al., 2019).

Krettenauer et al. (2020) talk about a time-out in adolescents'nature engagement and identify as a fairly universal fact. Also, Scandinavian research that explicitly takes the perspective of adolescents in focus shows that themes such as environmentalism are subject to what is called an 'adolescent dip' (Olsson & Gericke, 2016). Whereas children at the end of primary school are open to these topics both in terms of interest and attitude, there is a significant decline among adolescents in secondary education. Research confirms that the dip never recovers to the level observed in primary school children (Olsson et al., 2019). This highlights again the importance of stimulating nature connection among adolescents.

5.2.1 Health

Literature shows that nature connection leads to better physical and mental health (see e.g., Barrable & Booth, 2020; Kleespies & Dierkes, 2020). According to Kuo et al. (2019) nature connection decreases stress levels in adolescents. In addition, it results in the experience of a better emotional state and an overall higher experience of subjective quality of life (McCullough et al., 2018; Luís et al., 2020).

The improvement in mood by spending time in nature could be partly explained by the fact that exposure to sunlight triggers a production of vitamin D, and therefore an improved overall mood. Other physiological effects of exposure to nature are a reduced number of heart beats per minute, reduced blood pressure and a decrease in the concentrations of the stress hormone cortisol. These physiological effects generally go along with a state of enhanced relaxation of the body (Yao et al., 2021).

As Marselle et al. (2021) highlight, we should also recognize that nature can have adverse effects for the health of adolescents. Adolescents may get various insect bites after seeking out nature, or the cold or heat can cause discomfort (Winks, 2018). Increased fear of the dangers of nature (wild animals, allergies, nettles, etc.) has also been found to be a consequence of nature contact (Flett et al., 2010). Another health concern that often gains public attention is the nature-related health risk such as infectious diseases (WHO, 2016). Lastly, the creation of a bond with nature can also result in adolescents experiencing fear, sadness, or anger at the sight of destroyed natural areas (Tseng & Wang, 2020).

5.2.2 School Performance

Nature experience at school, starting even as 1 h a week, leads to more productive and emotionally more stable teenagers (Cross et al., 2019). The social abilities of adolescents, who come into contact with nature during school hours, are greatly improved as a result. Adolescents learn to cooperate better, to deal with conflicts better and to take the lead (Fischer et al., 2019).

In addition to the impact of nature connection on the development of social skills, nature connection stimulates cognitive capacities (Bowers et al., 2021). Research shows that OEE facilitates the application of practical knowledge and unlocks creative potential (Aladağ et al., 2021). Furthermore, nature connection is related to adolescents' academic performance. Several studies have shown that spending time in nature or the outdoors improves learning outcomes (Becker et al., 2017; Bowers et al., 2021). OEE improves adolescents' reflective thinking skills for problem-solving and ensures that learning will be more continuous based on the idea that adolescents learn by living and doing with authentic examples and models that nature provides. The positive effect of nature on students' academic performance is due partly to increased concentration and a different method of learning, such as learning in the garden or experimenting in the forest (Luís et al., 2020). Taylor and Kuo (2011) even suggest that spending time in nature may lessen the symptoms of attention deficit hyperactivity disorder (ADHD).

A recent study in Flanders demonstrated the importance of nearby nature for the cognitive development of adolescents (Steunpunt Milieu en Gezondheid, 2020). Adolescents with more nature in their neighborhood (e.g. trees, hedges, parks) scored better on attention tests and showed slower cellular ageing. Some cognitive functions that are important for learning ability and school performance (i.e., working memory and attention span) develop through adolescence (Ullman et al., 2014). Nature, thus, provides adolescents with unique opportunities to develop themselves and to feel better mentally, with positive effects on school performance (Boeve-de & Halbac-Zamfir, 2020).

Lastly, nature connection has a positive effect on the personal development of adolescents. Bowers et al. (2021) report a positive effect of nature on adolescents 'self-confidence, empathy, self-discipline, creativity, and sense of responsibility.

5.2.3 Environmental Citizenship

A combination of the above-mentioned competencies, such as growing empathy, curiosity and responsibility can lead to a more positive attitude towards nature. Various studies highlight the positive effect of school nature contact among adolescents on environmentally friendly attitude (Bahar & Sahin, 2017; Kleespies & Dierkes, 2020).

Nature connection is one of the known predictive factors for sustainable environmental behaviour inside and outside of school, as well as later in life (Uitto et al., 2015). Promoting nature experience during adolescence, e.g., through school interventions, can thus contribute to health and wellbeing at the individual level, but also to a more sustainable society. A recent large study, with adolescents in 100 schools in Belgium, showed a link between green school playgrounds and their knowledge about the environment and nature involvement (Boeve-de & Van Petegem, 2018). Work done in the context of the ENEC COST action points toward nature connection and positive experiences with nature during childhood and adolescence as crucial elements in the formation of environmental citizenship (Hadjichambis et al., 2020).

5.3 The Potential Role of Education in Nature Connection

An important finding in educational research on the role of nature in secondary education is the potential impact the school can have. Boeve-de and Van Petegem (2018) showed that the amount of nature, and the way in which schools work with nature, are meaningful for the nature connection of adolescents in secondary education. Even the mere presence of natural elements (trees, pond, hedges…) in schools stimulates the nature connection of adolescents. Boeve-de and Van Petegem's (2018) results furthermore show that when schools use the available on-campus nature as part of their pedagogical approach, adolescents report a significantly higher degree of knowledge about the natural environment and a more intrinsic motivation to contribute to the protection of nature.

While the previously mentioned study examined the impact of the availability and use of nature at school, there is also research that looks at how teachers can engage in OEE. In their recent update of the powerful learning environment framework (Decorte et al., 2004), Sinakou et al. (2019) emphasize the importance of OEE as an essential component of effective education for sustainable development.

5.4 Thresholds and Levers in Secondary Education

The above information shows that there is a central role for education in general and for the teacher's tasks specifically. However, in practice many difficulties are faced. Using the model of Creemers and Kyriakides (2010), we identify several thresholds and levers when integrating nature connection into the educational system. In what follows, we discuss the thresholds and levers for working on nature connection at three levels: 1) the level of the school policy, 2) the level regarding the learning environment and, 3) the level of the adolescents.

5.4.1 School Policy Level

OEE is largely marginalized in mainstream curriculum-based education in many educational systems. Although some schools do already teach outside or have green playgrounds, the potential to integrate this type of activities into daily educational routines is rarely fully utilized (Bergman, 2016). In spite of the positive effects of environmental education programs in which students spend time in nature, these initiatives bring serious organizational challenges: staggering expectations and obligations from the curriculum often do not allow for more extracurricular experiences than single-shot infrequent field days. Attempts to regularly teach outside based on the curriculum also encounter financial barriers. For example, in addition to an overcrowded curriculum and travel time, the cost of transport and extra teachers also appears to be an obstacle (Becker et al., 2017; Said et al., 2007). As a result, successful implementation becomes dependent on the commitment, efforts and enthusiasm of individual schoolteachers and their headmasters.

5.4.2 The Learning Environment

Adolescents appear to experience more freedom and less conflicts in greener classrooms at school. Nature at school has a positive effect on mental wellbeing because it reduces stress (McCullough et al., 2018). At the same time, a green school design can be used to compensate for the decrease in contact with nature outside the school (Kuo et al., 2019). This greening of schools can be tackled, for example, by the installation of a "green wall" (McCullough et al., 2018) or a large school garden where ingredients for the school kitchen are grown. The latter immediately illustrates and reinforces the relationship between food, health, and nature (Fischer et al., 2019).

In addition, physical proximity is a key driver when it comes to the learning environment. Lessons about nature in the neighborhood and in cooperation with the local environment have been shown to work better than lessons about nature further

away. The focus on local biodiversity provides a connection to adolescents' daily lives (Blanco et al., 2020; Sousa et al., 2016).

OEE can be emancipating. The circumstances outside the classroom are less controllable by the teacher and this requires greater input from the adolescents. Adolescents can, therefore, have more control over their own learning (Winks, 2018). OEE that focuses on natural and altruistic motives increases students' environmentally friendly behavior (Bahar & Sahin, 2017). By this, we mean lessons that focus not on the individual, but on the environment (natural) or others (altruistic). Furthermore, outdoor activities that address the interests of adolescents will lead to more eagerness for environmentally friendly behavior (Bergman, 2016).

Bergman (2016) shows that a teaching approach that focuses less on knowledge and more on the affective and sociocultural viewpoints of students about a particular environmental issue have a greater potential to increase nature connection in the long term. Bergman (2016) thus argues for a broader focus on the affective domain. However, not all teachers feel confident to include OEE in their teaching practice (Blanco et al., 2020). Becker et al. (2017) found that the implementation of OEE in schools is constrained by a shortage of skilled teachers.

In addition, teachers have to develop new teaching materials, adapt existing materials to the local context or rework existing lessons in a new way (Gardner, 2017). Existing schoolbooks are not always sufficiently detailed for teachers to allow for effective implementation. Research indicates that teachers face additional classroom management issues (Gardner, 2017). According to Gardner (2017), teachers worry about order and structure during an excursion or outdoor classes. Providing teachers with tools to set up that structure anyway could remove a barrier here. On the other hand, it is just as important that teachers understand that the structure of a learning activity in outdoor education can differ from activities in the classroom. This understanding can remove barriers.

Nevertheless, all teachers can inspire their students by demonstrating the desired behavior. In this way, they serve as role models for the adolescents. When teachers set certain actions or behaviors, adolescents become more motivated to behave in an environmentally friendly manner (Bahar & Sahin, 2017).

5.4.3 Thresholds and Levers for Adolescents

Some researchers consider nature connection to be a stable personality trait, making it difficult to change it in adolescents through a short school trip or outdoor class (Tseng & Wang, 2020). In addition, externally driven attempts to achieve increased nature connection can also be accompanied by negative feelings such as discomfort, anger, or sadness over the destruction of natural environments (Tseng & Wang, 2020). Therefore, programs that seek to intervene in adolescents' nature connection should take into account many thresholds, levers and possible (also negative) consequences. In this part of our chapter, we discuss the evidence present in the literature regarding

the thresholds and levers that are related to adolescents themselves: socio-economic and family background, gender, interests, and initial levels of nature connection.

Adolescents from families with lower socio-economic status (SES) tend to have less opportunity to engage in natural outdoor environments (Sedawi et al., 2020). They gain less nature experience as they grow up, while research has consistently regarded childhood and adolescence as the most important formative experience to lay a foundation for environmentalism. As we mentioned earlier, unequal access to or proximity to green space in the residential or learning environment can contribute to health inequality (Clayton et al., 2019). Therefore, OEE can provide a solution for more vulnerable adolescents with low SES. As the rules outside the classroom walls are different, adolescents are less likely to be excluded (Norwood et al., 2021).

The results of various survey studies show that girls score slightly higher on nature connection than boys. Girls also seem to be more concerned about nature and the environment than boys are (Sedawi et al., 2020). They also value nature more than boys do, although boys like the activities that take place outdoors more than girls (Sedawi et al., 2020).

In addition to gender, adolescents' interests also play a role in nature connection. People who have an interest in beauty have a stronger connection with nature (Merino et al., 2020). Programs respond to this work on nature connection through artistic work forms by using poetry, music, or nature photography. For example, the literature describes how writing lyrics in a natural environment can increase nature connection (Arbuthnott & Sutter, 2019).

Focusing on what adolescents already find interesting, builds a bridge to more contact with, and appreciation for, nature. Activities that lend themselves to this include skateboarding, skiing, sledding, building camps, making a snowman, canoeing, kayaking, water skiing, diving, rafting, camping, and geocaching (Flett et al., 2010). However, it is also important to provide adolescents with new experiences in nature. Many adolescents derive satisfaction and admiration from things they can do for the first time (Thomas et al., 2014). During an activity in nature, adolescents want to feel successful and enjoy being able to do things on their own (Flett et al., 2010). Adolescents indicate that connecting with nature is different for everyone. Some want to lie in the grass, others just want to look at nature, and others want to be active and climb mountains (Tseng & Wang, 2020). Thus, differentiation is key.

Finally, the initial level of nature connection of adolescents contributes to the impact of OEE. Adolescents who already experience a high level of nature connection gain less from a nature excursion compared to the group of adolescents with a lower initial level of connection (Barrable & Booth, 2020). For example, the study by Kleespies and Dierkes (2020) found that feeding sheep greatly increased the relationship between nature and adolescents with initial low nature engagement, but decreased the relationship between nature and adolescents with initial high engagement. Providers and facilitators of OEE should be aware of the level of nature connection of adolescents in order to provide tailored activities.

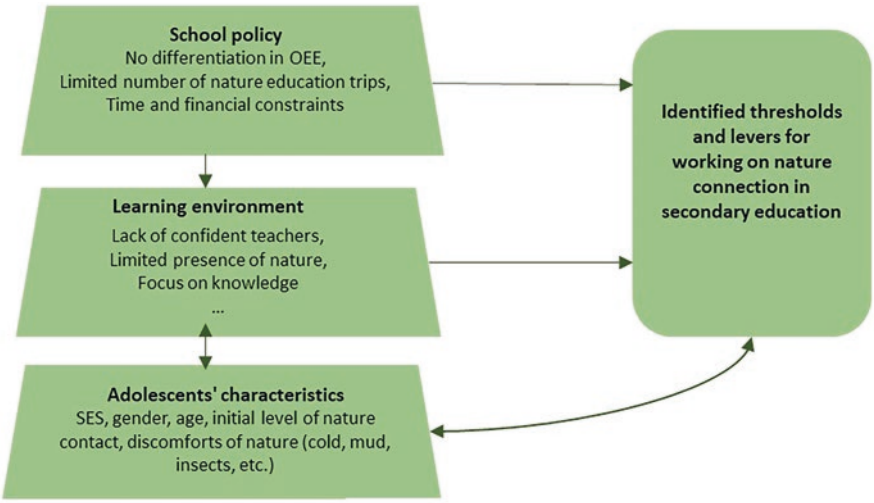

Fig. 5.1 Visualisation of the identified thresholds and levers for working on nature connection with adolescents in secondary education based on the literature, according to the model of Creemers and Kyriakides (2010)

Lastly, adolescents with a strongly developed nature connection can inspire their peers (Thomas et al., 2014). Going into nature together with friends provides an additional positive appreciation of the experience (Flett et al., 2010).

In conclusion, there are many aspects that can interfere with or enhance nature connection and sustainable- and environmentally friendly behavior through education. Figure 5.1. briefly summarizes these barriers.

5.5 Recommendations for Policy and Practice

In what follows, we outline recommendations for a future perspective based on the insights in this chapter. The common thread across all levels is the need for cooperation both within a given level (horizontal: e.g., cooperation between different departments) as well as between the different levels (vertical: e.g., between schools and their local environment).

Educational policy makers at national, regional, and local level

- Support bridging the gaps between the learning environment and nature, which currently exists in many schools. To this end, increase subsidies and support greening projects for schools and their surroundings. Local authorities, spatial planners or mobility policies should pay attention to creating a greener environment around schools, as well as greener routes to reach schools. In addition bridgebuilding can focus on the sectors of healthcare and environmental care, where potential win-wins can be detected, complementary to bridging the education – nature gap.

- Infuse connectedness to nature into national curricula for (sedondary) education, and/or highlight how the curriculum offers opportunities for schools and teachers to include OEE in their educational practice.

Schools

- Offer lessons to adolescents on the importance of nature for their academic performance and physical and mental health. The integration of nature connection in the school's health policy can be pivotal. You can rely on partners such as educational guidance services or the expertise of nature education centres.
- Support teacher (teams) to build confidence in OEE, e.g. through continued professional development.

Teachers

- Experiment with implementing diverse OEE activities to the attainment targets and curricula, preferably across different subject areas.
- Increase adolescents'interest in nature by focusing in OEE not only on knowledge, but also on experience. Learning by doing research in and about nature, in which adolescents themselves produce knowledge and not only reproduce it, ensures a greater motivation to act for the protection of nature. In doing so, be creative with the attainment targets, by linking the various nature-educational activities across different subjects to attainment targets.

Open/Ongoing questions and challenges regarding this aspect

- The potential importance of green playgrounds for students' mental well-being.
- Advocate the integration of a systematic evaluation of adolescent nature connection in the educational functioning of the centers. By monitoring the nature connection of adolescents, we gain a deeper insight into the effectiveness of these programs.
- A better integrated view on education, learning capacity, environmental care, and healthcare.

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