

# Outdoor Learning—Why It Should Be High up on the Agenda of Every Educator



## Introduction

Rolf Jucker and Jakob von Au

### 1 Why is High Quality Education so Crucial Today?

Whether you like Greta Thunberg or not, it is very difficult to argue with her analysis that we need immediate urgent action to stop, mitigate and adapt to climate change—that “empty words” are simply not enough (Thunberg, 2020).

Why are we starting a volume on outdoor learning with this provocative statement? Is this going to be some missionary, ideologically driven, radical environmentalist manifesto?

We would argue—on the contrary. There are several converging fundamental insights at play here which we need to focus on so that you, as a reader, can fully appreciate and critically evaluate what we are trying to do with this [book](#).

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A note on terminology: We are fully aware that there is a wide variety of terms used for what concerns us here: nature-based learning, school-based outdoor learning, real world learning, Education Outside the Classroom, Draußenschule in German (based on *uteskole* (Norway) and *udeskole* (Denmark)), *utomhuspedagogikk* (Sweden) etc. Platonet is at present trying to find an internationally accepted term (<https://www.outdoorplaycanada.ca/plato-net/>). We decided, for this volume, to use the broader term ‘outdoor learning’, since we believe that the value and benefits of this approach apply to learning out in the real world generally, not just for schools but also for other types of formal, non-formal and informal learning. However, we have deliberately not standardised the terminology because this can obscure the rich, diverse practices which feed what we showcase here. So it was the chapter author’s choice to use whatever terminology they preferred.

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R. Jucker (✉)  
Stiftung SILVIVA, Jenatschstrasse 1, CH-8002 Zürich, Switzerland  
e-mail: [rolf.jucker@silviva.ch](mailto:rolf.jucker@silviva.ch)

J. von Au  
Englisches Institut Heidelberg, Brechtelstrasse 27/2, 69126 Heidelberg, Germany  
e-mail: [vAu@englisches-institut.eu](mailto:vAu@englisches-institut.eu)

## 1.1 *Complex World with Many Mutually Reinforcing Challenges*

Maybe climate science and the Covid-19 pandemic have managed to help us appreciate a fundamental fact about our world: it mostly consists of complex systems, which can be defined as follows:

A complex system is a system composed of many components which may interact with each other. Examples of complex systems are Earth’s global climate, organisms, the human brain, infrastructure such as power grid, transportation or communication systems, social and economic organizations (like cities), an ecosystem, a living cell, and ultimately the entire universe.<sup>1</sup> Complex systems are systems whose behaviour is intrinsically difficult to model due to the dependencies, competitions, relationships, or other types of interactions between their parts or between a given system and its environment. (Wikipedia—Complex system, 2021)

Most serious challenges facing human society today are complex, systemic problems, often mutually reinforcing each other:

Crises in the natural world have reached a critical level. Inaction now threatens the very existence of human society: the Intergovernmental Panel on Climate Change (IPCC) warns that averting the most serious consequences of climate change requires a radical overhaul of the global economy, while the OECD argues biodiversity loss is among the top global risks to society. Importantly, the intersection between these crises deepens their effects. For example, deforestation is a major cause of biodiversity loss while also being the second largest source of anthropogenic greenhouse gas emissions. Meanwhile, growing inequality, the changing nature of work, and continued human rights violations are just some of the major risks facing global society and the financial sector that supports it. (ShareAction, 2020, 4; see also UNESCO, 2020, 6)

We don’t want to bore you with a litany of problems. However, the above discussion highlights two points which are important for us here:

1. There is no serious disagreement with the scientific consensus that almost anything of importance to human society is complex (including education and learning).
2. We can therefore not adequately approach such issues with simplistic, Twitter-sized soundbites, but only with appropriate systemic understanding.

## 1.2 *Humans Are Stretched to Their Limits to Understand the World They Live in*

The above sounds pretty straightforward. So let us just engage in such systemic learning and understanding, here with a focus on outdoor learning...

Or can we? As Jucker has shown in his book *Can We Cope with the Complexity of Reality?* (2020; see also Glasser, 2019), our human perception and cognition—as it evolved over time—is placing serious limitations on our individual capacity to

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<sup>1</sup> Even teams in organisations are complex systems which necessitates a high understanding of systems in order to lead them successfully (Mautsch and Metzger, 2019, 141–160).

understand the world around us. As Kahneman (2012) amongst others has shown, our normal, automated mode of interaction with the world—in Kahneman’s terminology “System 1”, others call it “old brain” (Hawkins, 2021)—is efficient for everyday life, but highly flawed and hampered by a whole host of biases which interfere with objective, reflective, reasoned attempts to figure out what is going on (i.e. what Kahneman terms “System 2”).

Or to put it more bluntly: From psychology and brain research we know that our personal experience, our personal knowledge, our memory, and even what we call our autonomous, inner ‘I’ or self are highly unreliable, often illusionary constructions of our brain. All of this is subject to a variety of perceptual distortions, psychological biases, and unreflected cultural prejudices (Jucker, 2020, 17–53). Only very rarely can we base reliable solutions on them:

Every-day thinking does not understand itself, is therefore uncritical and, if at all, only partially able to come to true statements. (...) Without a critical theory of itself and without a theory of the nervous system, everyday thinking (...) believes that it understands the material things in the world directly as they are (naïve realism). (...) Its implicit meta-theory is equal to the one in magical and religious world-views and is the source of resistance against the scientific world-view of adults. (Obrecht, 2009, 56; translation by the authors)

This poses a fundamental philosophical problem: given both that our evolutionary machinery severely restricts our understanding of the world,<sup>2</sup> and that we are dependent on a sound understanding of reality, if we want to successfully interact with it, what do we do?

Recent experiences, such as Covid-19, and a historical reflection on how reliable knowledge is created show us that we can only generate a meaningful understanding of the world if we can reliably distinguish between fact and fake news. For this, we need verification processes that only science can offer: openness, a culture of error and reversibility in the case of new findings, verification of results by different methods, reproducibility, verification by others, and evidence.

Humanity’s knowledge about reality, collectively acquired over decades, is therefore always more important than our personal, inevitably distorted mental model of it, which our brain is constantly constructing (Hawkins, 2021). This is the reason why state-of-the-art solutions to complex problems can never be provided by individuals, but only collectively, by teams, based on the best available knowledge (see Frith, 2007, 187). As a result, we must learn to take collectively verified knowledge (on climate change, for example) seriously and to mistrust our fallible pre-concepts, far too often guided by our personal interests, biases and prejudices. In other words, we need reasoned, evidence-based approaches:

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<sup>2</sup> This is the case even on very basic levels. The human ear can perceive a limited range of the entire sound spectrum (usually from 20–20’000 Hz, while some animals can hear from as low as 7 Hz to as high as 100’000 Hz (Wikipedia – Hearing range, 2021). Moreover, the human eye can only see what is called visible light, which represents a “very small portion of the electromagnetic spectrum”. Human vision ranges from 380 to 760 nm, whereas the entire spectrum ranges from Gamma rays at 1 pm (1 trillionth of a meter) to extremely low frequency radio waves at 100’000 km (Wikipedia—Electromagnetic spectrum, 2021).

The deliberate application of reason [is] necessary precisely because our common habits of thought are not particularly reasonable. (Pinker, 2018, 9)

### 1.3 *Learning and Education is the Basis for Understanding and Change*

If we take the fallibility of human perception and cognition together with the complexity of our world, then it emerges that understanding this world hinges on learning. This is the case for two reasons:

First, despite the limitations of human cognition, we are in for a chance: the way our brain works allows for continuous learning and correction of mistakes. In constant interaction with the real world, with experiences and things we learn, our brains correct and adapt the models of the world we base our understanding on (Hawkins, 2021; Frith, 2007). In other words, our brain is constantly learning, and there is no upper limit to what and how much we can learn (Bjork et al., 2013; Brown et al., 2014).

Second, contrary to the widespread opinion that it is enough to just pick one (however absurd) opinion and assume it is equally valid as any other, humanity has developed reliable processes since the Enlightenment that allow us to distinguish opinion from knowledge. When we use reason or System 2-thinking (Kahneman, 2012), and link it to a scientific approach (see Jucker, 2020, 37–43), “we can *learn* through criticism of our mistakes and errors, especially through criticism by others, and eventually also through self-criticism” (Popper, 1999, 84, italics in the original; see also Hawkins, 2021; Frith, 2007, 183; Rovelli, 2018, 132).

Therefore, it seems clear that we all need the best available, life-long learning, if we want to be able to both understand the world we live in and to be in the position to interact with and change it in ways which are meaningful, just and sustainable. To link back to Greta Thunberg’s provocation at the beginning: we all need to be in a position to move from (often empty) words to action.

You might think you are in the middle of a highbrow discussion, which has not much applicability to normal people and particularly school kids. However, for good reason most foundational texts for education bills or national curricula in democratic countries state something like the following:

In compulsory education pupils develop fundamental knowledge and skills as well as a *cultural identity which enables them (...) to find their place in society and the workplace.* (Grundlagen für den Lehrplan 21, 2010, 8; emphasis added)

The inter-cantonal Commission of Education Ministers of the French- and Italian-speaking parts of Switzerland affirms that the *transmission of fundamental values of communal life in a democratic society* as well as the acquisition of a sound general education is the corner stone of compulsory education for all. (CIIP, 2003, 1; emphasis added)

So it seems that the core of the enlightenment, as declared by Immanuel Kant, is still the basis for education:

Enlightenment is humanity's emergence from her self-imposed immaturity. (Kant, 1784)

A democracy (and the self-determination of the people in a community) can only function if the people involved in this process have the skills and competencies to act maturely in the spirit of Kant. Where people cling to the lips of authoritarian or religious leaders or (social) media to be told how to understand the world and what to do, this is certainly not the case. Therefore, the greatest challenge facing our education systems—it seems to us—is how to accompany children, young people, and adults into the self-determined maturity referred to by Kant more than 200 years ago.

## **2 What is the Importance of Outdoor Learning in This Context?**

### ***2.1 Education Systems Are Complex—A Call for Modesty***

Therefore the question arises: What does and does not work in education, if we look at it scientifically and not through the lenses of our goals, wishes and assumptions? It is clear that learning and teaching are multi-factorial processes, in other words highly complex systems. On the one hand, there are a host of underlying conditions and parameters from the macro to the micro level (see Fig. 1).

In the classroom, this includes things such as cultural and regional context, type of school, composition of class, school and class climate. With regard to teachers, we are looking at professional knowledge, technical, diagnostic, didactic and leadership competencies, cross-curricular and subject specific quality of teaching and teaching materials. With regard to students, these conditions and parameters include perception and interpretation of the teaching, family context (social class, richness of language environment, culture, familiarity with education, parenting, socialisation), the individual learning potential (previous knowledge, languages spoken, intelligence, learning and memory strategies, motivation to learn, willingness to make an effort, perseverance, self-confidence), and the use of learning time in class and in extracurricular activities (Hasselhorn & Gold, 2017, 237).

On the other hand, teaching and education are always only offers for learners: if and how this offer is taken up, is very much dependent on the learners and can therefore never be fully controlled by the educator:

In addition to the quantity and quality of the learning opportunities offered, the cognitive, motivational and emotional learning conditions of the pupils determine whether and how a learning opportunity is actually used. (Hasselhorn & Gold, 2017, 236; translation by the authors)

We would argue that we have not yet quite managed the 'evidence-based turn' in education. Far too much of our educational practice is still based on tradition, reproduction of our own educational experiences, fashionable trends and pseudo-scientific



**Fig. 1** Factors influencing a person at different levels

approaches. However, at least since Hattie (2008) we have a growing base to rely on if we are looking for broadly evidence-based strategies to make educational interventions work. Remember: evidence-based very often means counter-intuitive, as demonstrated by almost all of the history of science. Therefore, you will find quite a few surprises in Hattie's 252 influences related to student achievement (Waack, 2019), compared to your preconceived ideas about what might work. But it is certainly worth integrating these findings into what we do in any educational intervention.

For our purposes, we can focus on a few which stand out, also supported by other research. Firstly, the value of a good teacher cannot be overestimated. There has been a strong tendency, coupled with an oversimplified understanding of constructivism, that you do not really need teachers anymore, because learning happens in the learner. However, research clearly shows that this is not the case. Having a good teacher is undeniably central for student achievement, and it is far from trivial. Pedagogical and psychological research has highlighted the complex and demanding social, pedagogical and didactic-professional qualities, which characterise a good teacher (Weinert, 1996). Research into excellence has also reinforced this understanding and thoroughly debunked the myths around talent and genius. In order to learn and to succeed in any domain with a high level of competence requires a lot of dedication and years of practice (Brown et al., 2014, 18; Ericsson & Pool, 2016, 96, 207), in other words, "effortful learning", akin to "System 2"-learning. It also

requires a good dose of so-called non-cognitive skills (such as “self-discipline, grit, and persistence” [Brown et al., 2014, 199]) as well as tutors who give feedback in order to push and stretch learners not too much, but also not too little outside their comfort zone (Ericsson & Pool, 2016, 108).

In addition, it seems that collective learning is more effective—something everybody knows who floated his/her own ‘fantastic’ idea in a team, only to witness that afterwards this idea had matured into something clearly better, more complex and meaningful through the collaborative process (Rovelli, 2016, 6; Frith, 2007, 175; Rippon, 2019, 114; Dennett, 2017, 24, 378; Glasser, 2007).

We are left with a clear obligation to modesty and even humility. The insight that education and learning are complex systems means that we will only master them reasonably well if we face up to this complexity. Simplifications simply won’t help and the ‘one-size-fits-all’ guru-solution for everything does not exist. We must develop reliable immune responses to simple answers or black-and-white solutions. Not just in politics, but also in education and learning, we still largely have to do our homework and start acting based on evidence, not ideology or mission. Which begs the question: Are we ready to look at our educational practice with more humility, openness, willingness to learn and culture of error?

Furthermore, any educational intervention is at the very best only a small puzzle piece that contributes to human development and learning. Learning offers are only necessary, never sufficient, elements for the transformation towards a dignified, liveable future. We need not only in education, but also on all other levels of the system (politics, cultural values, economic system, incentives and disincentives, media, families, identity construction, etc.), manifold, scientifically well supported interventions. But these interventions, in turn, will not be sustainable if they are not undertaken with an open, Popperean scientific mindset. They need to be based on a democratic foundation and oriented towards freedom and responsibility. They need to be informed by the precautionary principle. And finally, they need to be in touch with, as well as in acceptance of, complex, non-linear, systemic reality (Meadows, 2009, 181).

This clearly also applies to outdoor learning. As with any other educational approach, we should therefore be very careful not to overestimate its potential impact and not to raise our expectations too highly.<sup>3</sup> It is certainly not the magic wand to solve all educational problems, let alone the rest of humanity’s predicaments.

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<sup>3</sup> Just two very different examples: a) There is a tendency in outdoor learning circles to overrate personal experience. However: “The world we perceive is a simulation [by our brain] of the real world.” (Hawkins, 2021, 175) This has consequences: “If you rely only on your personal experiences, then it is possible to live a fairly normal life and believe that the Earth is flat, that the moon landings were faked, that human activity is not changing the global climate, that species don’t evolve, that vaccines cause diseases, and that mass shootings are faked.” (ibid., 180)

b) We need to keep effect sizes in view. Mygind et al. write: “(...), it remains that sociocultural factors, such as percentage English learners, socioeconomic disadvantage, or presence of credentialed teachers, have a stronger bearing on healthy child development. In other words, within the socioecological totality of a child’s world, green space may play a role, but sociocultural factors will be decidedly more important.” (2021, 23)

## 2.2 *Outdoor Learning—A Sober Assessment*

Even though research into outdoor learning can be traced back to at least after World War II, its quality is still not anywhere near standards routinely used in other scientific fields (see chapter [How to Raise the Standards of Outdoor Learning and Its Research](#) in this volume; Mygind et al., 2019), if we understand science as “a social process that rigorously vets claims” (Oreskes, 2019, 141).

A recent, very thorough meta-study on the effectiveness of outdoor learning found only 13 studies—among a pool of 7830—that lived up to reasonable (not even high) methodological research standards (Becker et al., 2017). Studies in this area frequently suffer from poor study design and lack of methodological rigour in addition to representing very small numbers of participants. The duration of the intervention studied is often short; they tend to reflect special teaching situations rather than regular teaching; and they are generally neither randomized nor reproducible. Importantly, they mostly raise serious questions about the relationship, read influence, of researchers on the participants. Very often, they have a circular design—in other words, they tend to validate the initial hypothesis with notoriously unreliable, subjective self-reporting of the participants. Attempts to triangulate the collected data (*thick description*) or even to use objective measuring tools (such as measuring movement with an accelerometer rather than asking teachers if and how far pupils moved) are very rare indeed. Finally, the conclusions drawn are often not linked to the data (on the limited quality of research in the area, see also Mygind et al., 2019, 2021). So far, so bad. We may be forgiven to continue to dream about double-blind studies in education for a viable, dignified future. Nevertheless, despite these many challenges, there are bright spots of progress, such as some excellent papers in the volume *The Natural World as a Resource for Learning and Development* (Kuo and Jordan (eds.), 2019; see chapter [A Coordinated Research Agenda for Nature-Based Learning](#) in this volume) and the methodologically sound and very carefully executed TEACHOUT study in Denmark (Nielsen et al., 2016<sup>4</sup>; see [Udeskole—Pupils’ Physical Activity and Gender Perspectives](#) and [Pupils’ Well-Being, Mental and Social Health](#) in this volume).

## 2.3 *Outdoor Learning—Its Specific Contributions to Learning for a Viable Future*

Despite these clear limitations in terms of the established scientific quality of outdoor learning research and practice, there are a number of factors—particularly in the light of the above discussion about complexity and how learning works in humans—which seem to indicate that outdoor learning is not just a very important contribution to

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<sup>4</sup> For a list of the publications of the project see: <https://nexs.ku.dk/english/research/sport-individual-society/research-groups/physical-activities-during-school-and-leisure/gn-projects/gn-projects-completed/teachout-english/> Publications. Retrieved August 16, 2021.



the UN-proclaimed Sustainable Development Goal No. 4 (“Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all”; United Nations, n.y.; see Jucker and von Au, 2019), but to high quality education in general.

If we take a systemic look at today’s society, we are, as we have seen, confronted with various challenges: Climate and biodiversity crisis, democracy in times of social media and an increasingly digital world, integration and diversity, social, physical and mental health of students as well as teachers.<sup>5</sup> In order to master these challenges, we need resilient, healthy, mature people who can deal appropriately with the increasing complexity of the world and who can master the corresponding learning processes in high quality. We need ‘deepened social maturity’, in accordance with Kant.

If we look at children in this framework and ask ourselves what they need and what is good for them, then the following becomes apparent: Children have a right to the best possible development and nourishment of their potential. They have, as Carl Sagan beautifully said, a right to “wonder and scepticism” Sagan (1995), to diverse possibilities of perceiving, experiencing and exploring the world, i.e. to a successful understanding of the world. They have a right to the best possible learning processes, to experience self-efficacy, and to become competent at social learning.

Taking this social and child-centred view together, what is needed?

- Rich, diverse, dynamic and motivating learning spaces, learning opportunities and learning encounters,
- Enabling contact with the world and nature, understanding of the world and nature, understanding of the relationship between humans and the world/nature,
- Competence building for systemic thinking, understanding and acting,
- Experience of self-efficacy and transformation,
- Highest possible quality of teaching and learning experiences.

This is where learning in and with nature comes in. Outdoor learning supports successful learning on a very fundamental level.

First, some central aspects of learning appear in a new light, based on the progress made in brain and learning research in the last decades. As opposed to a computer hard drive whose storage capacity becomes exhausted, there seems to be no known limits to the human capacity for learning (Ericsson & Pool, 2016, 9, 40–41). Rather, we know now that the more we learn, the more connections we establish among different learnings, and the more we increase our capacity to advance understanding and our ability to learn (Ericsson & Pool, 2016, 43; Dirnagl & Müller, 2016, 260–261). The more we learn, the better we get at integrating and understanding issues, complex experiences, and abstract concepts such as Einstein’s General Theory of Relativity—in other words central concepts about how the world works (Bjork et al., 2013; Brown et al., 2014, 76, 199).

If we combine this insight with the finding that real, three-dimensional, multi-sensorial experiences activate a multitude of brain regions and faculties, leading to

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<sup>5</sup> Teachers in Switzerland, for example, have disproportionately high stress and burn-out levels (Sidler and Hunziker, 2016; Studer and Quarroz, 2017).

deepened connections among these regions and consequently to more resilience with regard to mental processes (Shaw, 2016, 251–252; Frith, 2007, 126–127; Dirnagl and Müller, 2016, 260–285; Brown et al., 2014, 167–168, 208–209), it seems inevitable to draw the following conclusion:

Learning that activates as many senses as possible (seeing, smelling, touching,<sup>6</sup> hearing, moving, ...), which takes place in dynamic, real-world learning environments, and which demands social interaction *and* self-guided involvement of the learners (Shaw, 2016, 139), is likely to be very effective. In addition, research shows that learning the same content while in motion, as opposed to being stationary, is more effective and evokes better long-term results (Dirnagl and Müller, 2016, 260).<sup>7</sup> If learners—and this does not only apply to children—are moving about, can touch things, view them from different perspectives, can smell, taste, and hear them, learning is more profound, more resilient and yields better long-term recall.

Second, mounting evidence indicates that real-world learning outside the classroom contributes to unlocking the full potential of learners. Since learning in and with nature takes place outside, in real, often unpredictable situations, which require quick comprehension, reaction, dialogue among each other, reflection and solution orientation, learning with nature contributes specifically to the competencies that we humans increasingly need in order to deal with the challenges we face in the twenty-first century (see chapter [Rediscovering the Potential of Outdoor Learning for Developing 21st Century Competencies](#) and chapter [Fostering 21st Century Skills Through Autonomy Supportive Science Education Outside the Classroom](#) in this volume). In the context of education for a viable future, learning outside is therefore well placed to help children and adults connect to all life and nurture the self-confidence and sense of agency that are necessary to take on the formidable responsibility of shaping humanity's common destiny. Learning in nature can also stimulate our innate desire to understand the world around us, thus increasing both motivation and our willingness to communicate and share with others.

Third, there is another reason why education—whether inside a classroom, in the community, at the workplace, in a research lab, or out in nature—is an indispensable tool for the change we need to an open, fair, just and sustainable future. Education can open up time and space to engage in “System 2” reasoning (Kahneman, 2012). It allows us to take the time needed to really understand an issue, with the help of outside experts, teachers and peers, texts, experiments, projects and much more.

<sup>6</sup> “Touch is not optional for human development. We have the longest childhoods of any animal – there is no other creature whose five-year-old offspring cannot live independently. If our long childhoods are not filled with touch, particularly loving, interpersonal touch, the consequences are dramatic.” (Linden, 2016, 4).

<sup>7</sup> Bearing in mind that human learning is fundamentally tied to movement (Hawkins, 2021, 34–35).

Education therefore allows us to run ‘living labs’ in order to try out and find solutions to the urgent questions mentioned above and to nurture a resilient immune response to ideological beliefs, religious dogmas, and fake news.

This much we can glean from the available, general research on learning, education and change. However, if we dig into the specific research on learning in nature—even when bearing in mind the limitations outlined in 2.2 above—we can summarise: learning in and with nature is overall effective learning, as it cumulatively promotes learning processes and health on different levels (see Mann et al., 2021):

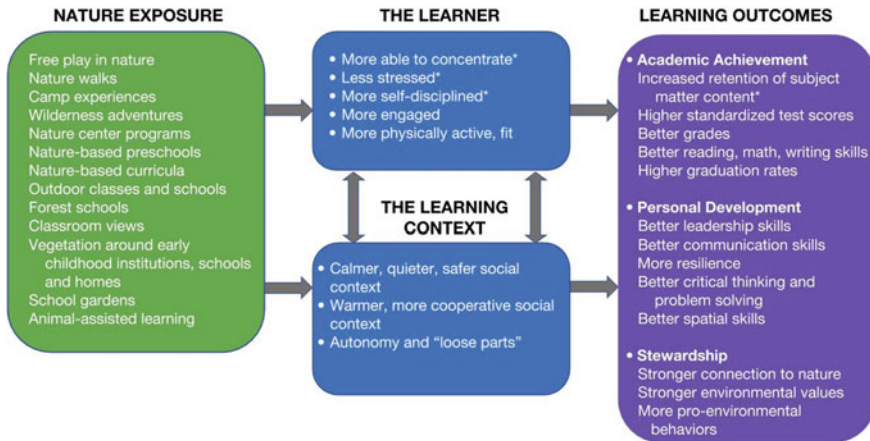
- *Academic learning success*: better recall of learning content, improved language competence (reading, writing, talking to adults, vocabulary), better solving of complex, interconnected tasks, better reasoning and analytical skills.
- *Social competencies*: strengthened social interaction, cohesion and trust between teachers and students, positive socio-emotional development, bearing in mind that a functioning learning community between teachers and students is a central condition for successful learning.
- *Self-competencies*: Increased intrinsic motivation and willingness to learn,<sup>8</sup> higher concentration, fewer disciplinary problems, high self-efficacy experience through discovery, experience-based and action-oriented learning, building a sense of identity, develop pro-social behaviour and personal executive functioning through risk-taking.
- *Physical and mental health*: Teachers and learners are significantly more in motion,<sup>9</sup> which makes learning more successful and makes learning content available in the long term, training of gross and fine motor skills, easier access to daylight<sup>10</sup> and fresh air than in classrooms, emotional and behavioural problems as well as hyperactivity are significantly reduced, especially in boys.
- *Real-world learning*: Rich and meaningful learning in real-world situations, different learning spaces serve the diverse learning needs of children in a variety of ways, which is more and more important in increasingly diverse classes.
- *twenty-first century skills*: Communication, cooperation, conflict resolution, creativity, critical thinking, resilience, self-regulation, dealing with the unexpected and complexity thinking are fostered.
- *Familiarity with nature*: Being close to nature and constructively dealing with the destruction of nature leads to increased environmental awareness and sustainable

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<sup>8</sup> A very interesting research result, not specifically linked to outdoor learning, is that teachers with a high motivation to continuously learn and improve their own professional competencies impact positively on the motivation of their students (Dresel et al., 2013).

<sup>9</sup> The most recent figures: compared to in-door classes, outdoor learning means up to 41.8 min less sedentary time, up to 36.4 min more light and up to 11.48 min more moderate to vigorous physical activity per school day (Bølling et al., 2021).

<sup>10</sup> As discussed in chapter [How Daylight Controls the Biological Clock, Organises Sleep, and Enhances Mood and Performance](#) and chapter [Outdoor Learning and Children’s Eyesight](#), this has important implication for myopia prevention. A recent review from China stated: “To prevent myopia at younger ages, measures must be implemented, such as conducting school classes outdoors, incorporating more outdoor activities into the school curriculum, and providing additional outdoor programs for children on weekends.” (Zhang and Deng, 2020)



**Fig. 2** Nature-based learning: exposures, probable mechanisms, and outcomes (from: Kuo, Barnes and Jordan, [https://doi.org/10.1007/978-3-031-04108-2\\_3](https://doi.org/10.1007/978-3-031-04108-2_3))

action (see chapter [Childhood Nature Connection and Constructive Hope](#) in this volume).

As a comparison with Hattie's list of factors for successful learning shows (see above, Waack, 2019), learning in and with nature cumulatively promotes many important foundations that make successful learning possible in the first place. In this way, learning in nature also supports children whose integration in the classroom is often a challenge (Fig. 2).

We believe that it is this *cumulative, fundamental fostering of learning in multiple dimensions* which is the core contribution of outdoor learning to high quality learning. Kuo, Barnes and Jordan (see chapter [Do Experiences with Nature Promote Learning? Converging Evidence of a Cause-And-Effect Relationship](#) in this volume) have summarised this well in Fig. 2:

This cumulative fostering of high-quality learning also qualifies outdoor learning as an approach to support SDG 4 and Education for Sustainable Development (ESD), irrespective of theme or topic. The Scottish *Curriculum for Excellence through Outdoor Learning* expresses this well:

*Curriculum for Excellence* offers opportunities for all children and young people to enjoy first-hand experience outdoors, whether within the school grounds, in urban green spaces, in Scotland's countryside or in wilder environments. Such experiences motivate our children and young people to become successful learners and to develop as healthy, confident, enterprising and responsible citizens. Well-constructed and well-planned outdoor learning helps develop the skills of enquiry, critical thinking and reflection necessary for our children and young people to meet the social, economic and environmental challenges of life in the twenty-first century. Outdoor learning connects children and young people with the natural world, with our built heritage and our culture and society, (...). (Learning & Teaching Scotland, 2010, 7)

In fact, since all change rests on learning and outdoor approaches boost learning, it can even support the implementation of all the other 16 SDGs. Contrary to the often very conceptual and abstract discussions and propositions in ESD, outdoor learning is a very practical, easily implementable tool to enhance high quality learning directly. Particularly in terms of transforming teaching practice for learners in the best possible way, we believe that outdoor learning has a lot more direct implications and also chances of success, particularly since outdoor learning is at best an add-in approach which requires very little extra resources—a fact which is very important with a view to teacher acceptance and equitable access to high-quality learning, particularly in poor communities (see Bentsen et al., 2021).

However, as mentioned above, learning in and with nature is not the panacea for solving all problems in school. It is one of many useful, evidence-based, effective ways to support teachers and school teams in their daily work. But since outdoor learning, as understood here, is an add-in (directly enhancing and supporting high-quality curriculum-based work) and not an add-on (requiring additional time and resources *beyond* curriculum-focused teaching) approach,<sup>11</sup> it is not a question of burdening the school with yet another task beyond the curriculum, but rather of supporting its core business, namely teaching and learning.

Our understanding of outdoor learning in this volume is the following:

- curriculum-based teaching&learning activities outside the classroom but in school hours
- setting-sensitive, problem-based, experiential education
- pupil-led, teacher-facilitated learning
- inclusion of PA not as a goal but as a means to pedagogical and didactical ends
- regular activities on a weekly or biweekly basis. (Bentsen et al., 2021, 3)

### 3 Why This Book and Its Very Specific Approach?

We have now provided you with some of the evidence and many substantiated claims regarding the value and the specific contributions outdoor learning can make in a time where high-quality learning might never have been more important.

However, you might be quite justified to ask: why yet another volume on this? We have had the wonderful *Frontiers* volume, edited by Ming Kuo and Cathy Jordan (2019), we have all the papers from the TEACHOUT project available (see Footnote 4 above), we have the excellent books, edited by Sue Waite (2017 and 2019), and then there is *The SAGE Handbook of Outdoor Play and Learning* (Waller et al., 2017)—amongst others.

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<sup>11</sup> Add-in is already good, but maybe we also have to think about subtractive solutions. There is interesting research which shows that the constant exposure to additive solutions makes them cognitively far more accessible: “It thus seems that people are prone to apply a ‘what can we add here?’ heuristic (a default strategy to simplify and speed up decision-making). This heuristic can be overcome by exerting extra cognitive effort to consider other, less-intuitive solutions.” (Meyvis and Yoon, 2021, 189) The authors conclude that we need “to guard against the default tendency to add.” (ibid., 190)

There are several reasons why we are convinced that this book is unique and serves a very specific purpose quite unlike any of the others. It should help launch and sustain discussion, debate and finally implementation of outdoor learning on a broad scale, on different systemic levels.

Our aim is clearly not to produce a straightforward scientific volume with research papers never published before. The volume is *not* directed at specialist researchers—they know their field inside out, know where to go for new research and have access to all the papers they need through their institutional access systems. Producing such a book takes far too long to be of interest to cutting-edge researchers. The volume is also *not* aimed at the average teacher who is looking for practical guidance on how to implement outdoor learning. This market is quite saturated in different countries (see, as examples, Waite et al., 2020; SILVIVA, 2018 and 2019).

We aim for another audience in that we try to bridge the gap between these two worlds. We provide you with a reader or compendium, mixing the carefully selected, best internationally available, highest-quality evidence with new, original contributions:

- In Part I (chapters [A Coordinated Research Agenda for Nature-Based Learning](#), [Do Experiences with Nature Promote Learning? Converging Evidence of a Cause-And-Effect Relationship](#), [Refueling Students in Flight: Lessons in Nature May Boost Subsequent Classroom Engagement](#), [Childhood Nature Connection and Constructive Hope](#), and [How to Raise the Standards of Outdoor Learning and Its Research](#)) you find the very best in terms of the scientific case for outdoor learning. This ranges from a holistic reflection on which research is needed, to the succinct provision of the evidence, in broad and narrow perspectives, to quality criteria for this research. It gives you a very good feel for how far the field has advanced in recent times, despite the limitations mentioned above.
- Part II (chapters [Udeskole—Pupils’ Physical Activity and Gender Perspectives](#) and [Pupils’ Well-Being, Mental and Social Health](#)) gives you a unique insight into a high-quality flagship research project: the TEACHOUT study from Denmark, from which we publish two summary papers.
- Part III (chapters [Some Impacts on Health and Wellbeing from School-Based Outdoor Learning](#), [How Daylight Controls the Biological Clock, Organises Sleep, and Enhances Mood and Performance](#) and [Outdoor Learning and Children’s Eyesight](#)) is specifically focussing on mental, physical and social health. Outdoor learning has unique contributions to make here (also touched upon already in Part II), both for pupils and teachers. We approach this both from an inside perspective from top-outdoor learning specialists in the UK, but also from the outside: we have asked two internationally recognised specialists who have no connection or vested interest in outdoor learning, to assess its health potential from their professional perspective: chronobiology and health in the built environment respectively.
- Part IV (chapters [Rediscovering the Potential of Outdoor Learning for Developing 21st Century Competencies](#) and [Fostering 21st Century Skills Through Autonomy Supportive Science Education Outside the Classroom](#)) is providing arguments and evidence for the claim put forward in this introduction that outdoor learning is

important for fostering the competencies all of us need to come to terms with the challenges of the twenty-first century.

- Part V (chapters [Research and Documentation of Outdoor-Based Teaching in Teacher Education—The EOT Project](#), [Bonding with the World: A Pedagogical Approach](#) and [Udeskole—Regular Teaching Outside the Classroom](#)) homes in on one aspect which is almost religiously mentioned in every single recommendation on outdoor learning of the last decade: if we don't nurture and develop the necessary competencies of teachers (and teacher trainers for that matter) to teach outdoor learning to a high standard, it will not be embedded across school systems anytime soon.
- Part VI (chapters [International Views on School-Based Outdoor Learning](#), [Natural Connections: Learning About Outdoor-Based Learning](#), [Outdoor School in Germany. Theoretical Considerations and Empirical Findings](#), [Investigating Experiences of Nature: Challenges and Case-Analytical Approaches](#) and [Creating a Forest for Learning](#)) finally both broadens and focusses our perspectives. From a fascinating international insight into outdoor learning we turn to nation-wide and individual case-studies, which provide the richness and depth of the territory which we have mapped out before.

By providing a veritable 'best-of' of recently published and new articles on the impact of outdoor learning, offering sound evidence, but also a rich tapestry of limitations and challenges, of exciting insights and success stories, we give you the learning tools to make outdoor learning 'doable' in your context.

We are not going to walk you through each individual chapter—we have provided abstracts for this reason. But just as a teaser, and really only *pars pro toto*, we give you a distinct flavour of our selection approach. Chapter [Refueling Students in Flight: Lessons in Nature May Boost Subsequent Classroom Engagement](#), written by Ming Kuo, Matthew H.E.M. Browning and Milbert L. Penner, is really far too long and a reprint, you might say. Why do we still include it? In our view this paper is a perfect example of really carefully carried out, thoughtfully reflected research which can very well serve as a template for others to either do their own research or model their practice on it. Chapter [How to Raise the Standards of Outdoor Learning and Its Research](#) is a summary of a rather oldish paper. Again: why include it? Just the summary gives such a rich diet of why scientific rigour on the part of the researchers, and conceptual clarity on the part of education providers (i.e. the need for a Theory of Change) is so crucial, that it might well be declared compulsory reading for every researcher and every teacher and educator in the field.

Through this unique approach, we are able to present a rich, varied picture of reasons and insights into outdoor learning which is aimed at those interested readers, who want to go beyond the merely practical and are not specialists enough to dive on a daily basis into hard-core science papers. It is for those people who need a more than superficial understanding of the issues at stake, because they shape education, as policy makers, civil servants, directors of teacher training universities, teacher trainers, head teachers, and parents sitting on boards of educational authorities. It is furthermore aimed at teachers with an interest in developing their professional

competencies and at professional educators, coaches and multipliers who train staff of educational NGOs.

In addition, the volume not only focusses on outdoor learning as an educational approach. It has itself an educational aim. We are very much aware of the fact that the intended audiences are broad and that this poses problems in terms of style. However, we were driven by a twofold educational intent. On the one hand, we have encouraged contributors to have readability in mind. We also aimed to enhance the ‘way into the texts’ with an abstract (unfortunately only in the online open access version), a bio statement about the authors, photos of the authors and a short recommended reading list of their preferred three titles in the field. On the other hand, given the need for an evidence-based approach, we aim to encourage and ‘push’ our audiences to really dare and plunge into ‘proper’ scientific texts: in Denmark, for example, continuous professional development training for outdoor teachers deliberately forces teachers to read scientific papers as is, with no ‘translation’. If we are serious about the above-mentioned insight that we cannot understand our world, and act meaningfully in it, without adequate scientific understanding, then all of us need to develop both the courage and the competencies to read and understand scientific writing.

This really is the background to our ‘idiosyncratic’ approach: since we want to enhance the understanding and acceptance of outdoor learning, we need to provide a variety of approaches. We do know that every single target audience we aim for is in itself very varied again, from those who really need a simple ‘translation’ to those who quite happily dig into ‘real science’. We are convinced that we offer a suitable variety of texts for this ‘natural’ spread of readers—from chapters where the authors support readers by explaining scientific terms in footnotes to chapters which read like essays rather than a paper in *Science* or *nature*.

If you walk away from reading parts or the whole of this book with a deepened and broadened understanding of outdoor learning—i.e. a “System 2” understanding—then we have achieved our aim.

## **4 Vision—What is Needed?**

Given the systemic approach we pursued and our target audiences, all the recommendations we present here are intended for multiple stakeholders. For example, if we identify research which is dearly needed, then not just researchers should feel called upon, but also politicians who can allocate the money and teacher training institutions who might benefit from the results. In fact, if these groups of people were to cooperate right from the very start, this would in all likelihood not just improve the validity of the research, but also bridge the science-practice gap and make sure that up-to-date results and insights are actually taken up by the practitioners in the field—a notorious problem we are confronted with in all areas of education. We therefore encourage you to read the following in this spirit, and, if in doubt, feel responsible!



It is for good reason that we have included Cathy Jordan and Louise Chawla’s [A Coordinated Research Agenda for Nature-Based Learning](#) as the very first chapter after the introduction. This piece is valuable for a wider audience not just for the very thorough and systemic perspective it takes (looking at learning outcomes, differential effects, the mechanisms by which nature and learning are linked, and the implications for policy and practice, see chapter [A Coordinated Research Agenda for Nature-Based Learning](#), Table 1). It can also serve as a template for broad and inclusive processes, involving many different stakeholders, with the aim to arrive at the best possible result as well as launching a continual, focused process of future research. Jordan and Chawla have identified three domains for the latter:

1. learning outcomes, including understanding how learning in nature compares with learning in classrooms, preschools and child care centers, and how outcomes may vary by age, gender, socioeconomic background, ethnic background, individual differences, or special needs;
2. the mechanisms that explain relationships between nature and learning; and
3. how to most effectively apply research to policy and practice (chapter [A Coordinated Research Agenda for Nature-Based Learning](#)).

We have also seen above that research in the area in general could benefit from a serious reflection on research quality, including learning from other fields of research where standards are much higher—as mentioned, TEACHOUT has here been a trailblazer (Nielsen et al., 2016 and chapter [Udeskole—Pupils’ Physical Activity and Gender Perspectives](#) and chapter [Pupils’ Well-Being, Mental and Social Health](#) but also see chapter [How to Raise the Standards of Outdoor Learning and Its Research](#)). In the meantime, a number of systematic reviews on the effects of outdoor learning have been published which have reconfirmed some serious limitations regarding the quality or diligence of some research in the area (see, for example, Becker et al., 2017; Mygind et al., 2019, 2021; Dankiw et al., 2020). Be it sample size, mistaking correlation for causation, overestimating effect size, a narrow focus which excludes a systemic understanding of the hierarchy of factors influencing learning, understating the ambiguity of findings, insufficient quality of the models used, etc.—these aspects found in some research has lead one recent systematic review to conclude for the area they looked at: “The empirical evidence must currently be considered limited.” (Mygind et al., 2021, 22) Another systematic review on the impacts of immersive nature-experiences on mental, physical and social health of children had to state repeatedly: “The quality of the evidence was considered low owing to risk of bias and imprecision due to small sample sizes.” (Mygind et al., 2019).

Therefore, there is clearly plenty of room for improvement in the quality and scope of outdoor learning research. A recently published research protocol, co-written, amongst others, by four authors represented in this volume (Jeff Mann, Tonia Gray, Son Truong and Rowena Passy), has pointed out one particular area of concern, despite the mounting evidence “for developmental and well-being benefits on children and adolescents” through outdoor learning:

The effect of Outdoor Learning on academic metrics remains under-researched. Indeed, many outdoor educators lament one of the key factors limiting Outdoor Learning from taking a

greater role in mainstream education is the paucity of evidence demonstrating its impact on academic curriculum performance. (Mann et al., 2021, 3)

But let's not just look at research but a wider perspective. Even if we take all the limitations mentioned above into account,<sup>12</sup> the collected evidence and arguments in this volume (and much of the wider work it was nourished by) clearly points to the insight that outdoor learning has an important role to play in an education system, which wants to be 'fit4future'. Because of its 'add-in' approach, i.e. "direct integration with curriculum time and aims", but also due to "extensive teacher acceptability, the whole-population application (...) and low associated costs" (Bentsen, 2021, 5), outdoor learning might indeed be one of the keys unlocking the potential that high-quality learning can offer to our kids. If we look to places where really game-changing, substantial learning takes place, which makes learners truly grow, it is almost always focussed, motivated, real-world learning for a purpose (see Ericsson & Pool, 2016). Outdoor learning can be a stepping stone for such learning journeys, because it nourishes important elements of successful learning: it keeps the motivation high, it nurtures the social bond between teachers and learners, it takes place in movement and interaction—you can complete your list of favourites while reading this book.

However, what is needed that this vision of an education which develops not just at best the potential of all kids, but also secures a viable future for humankind, moves from "empty words" into action?

One of the most impressive examples of an attempt to systemically integrate outdoor learning regularly into the compulsory school system has been Denmark. It is also a particularly interesting case, because the progress of this implementation has been regularly measured (Barfod et al., 2016, 2021; Bentsen et al., 2010). The latest survey noted that "the curve is flattened", i.e. that the percentage of schools practicing regular outdoor learning, is not increasing by much anymore (it lies at "approximately one-fifth of general schools in Denmark" in 2019). But two results are interesting: within these schools "the number of classes using regular EOtC (Education Outside the Classroom) increases significantly" and "one third of all special-needs schools work with regular EOtC" (Barfod et al., 2021, 5). So maybe we should be looking at saturation and how to deal with it, and at circumstances, where outdoor learning can provide an even bigger benefit, such as in special-needs schools.

Apart from maybe Scotland it is very rare to find such a systemic, concerted effort as in Denmark to really transform schooling. The way our Danish colleagues have simultaneously used national networks, teacher training, peer-to-peer learning, research, influencing policy and much more, can certainly serve as a role-model for many other countries. At the height of the Covid-19 pandemic, which had "fostered the interests in using the outdoors during both school and leisure time" (Barfod et al., 2021, 5), due to the ease for distancing and lower infection rates, the Danish

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<sup>12</sup> Let's be fair: many of the limitations have also to do with the fact that outdoor learning as broadly understood as it is here is a nascent field and similar limitations plague much more established educational interventions.

Prime Minister, on primetime TV, urged all Danish School to teach outdoors whenever possible—something other countries can only dream of (except maybe Austria, where the Education Ministry issued a similar suggestion).

In Switzerland, we have certainly tried hard to emulate the lead of Denmark. SILVIVA, the Swiss Foundation for Nature-based Learning, has initiated an ambitious national, trilingual project with the aim that every pupil in Switzerland can profit from the multiple benefits of outdoor learning during their school career—and their teachers as well. Based on the insights presented in chapter [How to Raise the Standards of Outdoor Learning and Its Research](#), SILVIVA has drawn up a Theory of Change to facilitate the transformation into an education system, where resilient, healthy children, youth and adults unlock their potential and learn to deal competently with a complex world—individually and collectively. Using an approach that is systemic, supportive, embedding, cooperative and participatory, using iteration, ideation, adaption and error tolerance, SILVIVA aims to use all the international and national knowhow as well as personnel and financial resources of its own and a broad range of partner organisations to sustainably anchor outdoor learning on all levels of the Swiss education system. Copying the Danish lead and inspired by the holistic approach presented in chapter [International Views on School-Based Outdoor Learning](#) (see Fig. 1), SILVIVA is focusing on building up local, regional and national networks; online platforms providing resources, exchange and support; encouraging necessary research; embedding outdoor learning in initial and continuous teacher training (a crucial, still very much under-researched and supported approach, see chapter [Research and Documentation of Outdoor-Based Teaching in Teacher Education—The EOT Project](#)); making it part of head master professional qualifications and supporting its integration into school culture and school development plans. Embedding means a shift and project, to institutional anchoring in an organisation (be it a school, educational authority, teacher training institution or a research department). Encouraged by the *National Curriculum Outdoors* series (Waite et al., 2020) it has become clear that an important driver for embedding are teaching materials (which are influencing teaching practice more than curricula) and increasingly national tests, but also national and international surveys (such as PISA) and software assessing student achievement. Once again encouraged by best practice in other countries, SILVIVA is also focussing very much on raising the visibility, legitimacy and acceptance of outdoor learning on all systemic levels, from national to regional decision makers, to parents and the general public, using a broad range of communication, coaching and training tools.

We are not elaborating on this to showcase Switzerland—it is some way behind other countries in many respects. Nevertheless, we are mentioning it because we are convinced of the importance of integrated, systemic approaches to fostering outdoor learning—an activity manual and a few courses for teachers will not do the trick.

There is also another important dimension to consider here. Research on successful social change, such as peoples' professional practice, clearly shows that this happens best in mutually reinforcing learning communities. When people know each other, can practice new behaviours together, can share and look over each other's shoulders, then new things, such as outdoor teaching, are not only recognised

as good, but are effectively integrated into one's own professional practice. For other schools and teachers, this practice is then evidence that this could be useful and an incentive to try it too. By building up such pockets of good, tried and tested practice new approaches such as outdoor learning can truly spread and get systemically embedded. Centola has carefully researched such change mechanisms: "Successful social change is not about information; it's about norms." (Centola, 2021, 11) In Sociology, it is now accepted that "social networks are the crucial factor for social change." (ibid., 30) Centola therefore speaks of the need for "strong ties", "wide bridges" and "complex contagions" (i.e. multiple, reinforcing 'infections') to change social norms and established behaviour: you don't change unless you see people you know and trust adopt the new practice, multiple times:

None of the major behavioral or social changes that have happened in the last half-century have spread the way viruses do. They have spread not through *reach* but through the phenomenon that, for years, network scientists believed to be the great enemy of effective contagion: *redundancy*. (...) Redundancy will not help to spread the measles. You can't get infected twice—it takes only one contact to do it. But when it comes to a new idea, the experience of being exposed to it from two, three, or four people within your network of strong ties—that changes the idea into a norm. It changes how you think and feel about it. And that is the overlooked power of redundancy. (Centola, 2021, 49)

You cannot force-feed people to change. You need a "System 2"-approach: slow, reflected, careful, testing, adapting, changing, improving—precisely the reason for the broad variety of arguments, approaches, styles and reflection we present in this volume, to help you adopt a "complex contagion" approach to embedded outdoor learning. This will help to make sure that words do turn into action.

So far, so good. We have role-models, tried and tested approaches, a growing body of sound evidence which testifies to the multiple reinforcing benefits of outdoor learning for academic learning, social interaction, personal development and well-being, mental, physical and social health, creativity, and much more. So we can get to work and we truly hope that this book will serve as a toolbox for you to do so.

However, if you think back to the beginning of this chapter there remains one hard nut to crack. Given what we know about our evolutionary machinery as well as the limits to our perception and cognition, systemic thinking, understanding, and action does not come to us easily—on the contrary, because "laziness is built deep into our nature" (Kahneman, 2012, 35). Systemic understanding is an extreme version of a "System 2"-task: difficult, effortful, counterintuitive, and strenuous. Speaking to many experienced educators and experts, it seems to us that there are hardly any tried and tested, effective educational interventions which help children, youth and adults to train and competently learn systemic understanding, and then even make it their preferred path of reflection, whatever the issue at hand. If you know of such learning interventions, which ideally have been validated by research, by all means get in touch with us.

The trouble really is that systemic understanding is rich in prerequisites: you need to understand systems at a profound level, so that you are capable of grasping any

other system that might be thrown your way in sufficient depth; you need to understand fundamental principles of life (i.e. evolution, physics, chemistry, biology, sociology, economics), so that the most flawed preconceptions about life are cleared up; you need to understand the evolutionary machinery of human perception and cognition (including the fundamental principles of how the brain and learning work), so that a realistic self-assessment is at least possible; you need to have at your disposal various tools and methods which help you to move from System 1 into System 2, so that a distanced, self-reflective, self-critical, careful, intersubjective understanding can be generated, based on the best available evidence; you need a willingness to learn and change and a fostered culture of error (Carl Sagan’s “wonder and skepticism”); and finally, you need to translate all of the above into concrete, real-life action. In other words, we all need to become change agents who accomplish the art of “skilful muddling”, as Harold Glasser aptly calls it (2019, 64). In essence, what we are talking about is reapplying Kant’s quest for “humanity’s emergence from her self-imposed immaturity” (Kant, 1784) to today’s challenges.

Given the challenges we face as a species, establishing such systemic learning interventions should have a very high priority. We have started dreaming of concocting a cook-book (of whatever format) for complexity learning which fills this gap. The idea is to collect functioning examples on all levels, presented in such a way, that everybody can cook them, i.e. replicate them. Please do get in touch if you would like to be part of a team to find out.

Let us end on this reflective note:

The main message today has to be, with [Svenja] Flaßpöhler: *differentiation*. Unless we all become a lot more accurate, evidence-based, and work with up-to-date knowledge rather than System 1 easy answers, assumptions, old mental models, traditions or beliefs, we will hardly make headways towards the open, just, free and democratic vision I developed at the beginning [of the book]. (...) We need to encourage System 2 – slow, serious, careful and systemic analysis, thinking and action – any time over System 1. (...) Maybe this just means that we as educators have to truly embody, live with every cell in our body, the scientific approach: always be open to learn. History teaches us that traditional explanations mostly don’t work, and, in time, get replaced: So, we need to have an open mind and be prepared to throw them out if evidence comes to the fore to disprove them (even if they are dear to us or our System 1)! Ericsson and Pool, in their study on excellence (2016), have shown that we all can do this: there is no genetic predisposition which makes this only available to some; a democratic message I find heartening and liberating. (Jucker, 2020, 103–106)

## Recommended Further Readings

1. Capra, Fritjof, and Pier Luigi Luisi (2014). *The Systems View of Life. A Unifying Vision*. Cambridge: Cambridge University Press.
2. Shaw, Julia (2016). *The Memory Illusion. Remembering, Forgetting, and the Science of False Memory*. London: Random House Books..
3. Jucker, Rolf (2020). *Can We Cope with the Complexity of Reality? Why Craving Easy Answers Is at the Root of our Problems. Reflections on science, self-illusions, religion, democracy and education for a viable future*. Newcastle upon Tyne: Cambridge Scholars Publishing. <https://www.cambridgescholars.com/product/978-1-5275-4851-0>

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**Rolf Jucker** is currently Director of the Swiss Foundation for Nature-based Learning (SILVIVA) and a learning for sustainability expert, having previously served as Director of the Swiss Foundation for Environmental Education from 2008 to 2012. He gained an MSc in Education for Sustainability (EfS) and worked extensively on education for a viable future, publishing widely on the subject. He is the author of *Do We Know What We Are Doing?* (2014) and *Can We Cope with the Complexity of Reality? Why Craving Easy Answers Is at the Root of our Problems* (2020).



**Jakob von Au** currently works at the Englisches Institut Heidelberg as a teacher and at the University of Education Heidelberg as a lecturer in Outdoor Teaching and Education for Sustainable Development. He is the co-editor of the first substantial collection of research on outdoor-based learning in German, “*Raus aus dem Klassenzimmer*”: *Outdoor Education als Unterrichtskonzept* (2016).

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