

Nurturing nature connectedness through primary education?

A study into the role of nature experiences in primary education in The Netherlands in children's connectedness to nature as precursor of pro-environmental behaviour



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Master thesis Forest & Nature Conservation

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*"Earth and sky, woods and fields, lakes and rivers,
the mountain and the sea, are excellent
schoolmasters; they teach us more than we can ever
learn from books." — John Lubbock*

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Preface

As the final piece of my career as a student I chose to step out of my comfort zone (or maybe to finally come home). Throughout all my years at the university I have been trying to find what it actually is I want to contribute through science to the world in which we live. Starting of as a first year bachelor student in Psychobiology at the University of Amsterdam I realized that this was not at all what I thought the be the essence of such a contribution. Idealistic as I was (and probably still am) I wanted to do something more substantial, something that helps me to understand the world from a broader perspective and that would give me the opportunity to contribute to the conservation of the world we all happen to be part of. Thereby not merely focusing on human beings and classical science, but including the rest of the natural world in a more interdisciplinary way. I found this in my second bachelor programme, Future Planet Studies (UvA). Here I was able to dive into the wonders of ecology from a broader and more interdisciplinary point of view. The programme motivated me even more to continue in the field of nature conservation, which made me end up in the master programme Forest & Nature conservation at the University of Wageningen. Throughout my master programme I have still been searching a middle way between the natural science of ecology and the social science of the human-nature relationship. Though regarding research I was way more experienced in the more exact, natural sciences, I realized that for me the most essential field of study regarding nature conservation might not be biology, forestry or other natural sciences (though they are **HIGHLY** important!), but in fact the social sciences regarding the human-nature relationship. I started to follow courses on more anthropological, social and philosophical aspects of nature conservation, read books, visited public lectures and found a whole new world of science around nature conservation that highly interested me. I realized this came much closer to the essence of my scientific (or even life-) purpose and I decided to step in this (for me) new but exciting field of science. Inspired by (amongst others) lectures of Prof. Dr. Matthijs Schouten (WUR), Dr. Koen Arts (WUR) and the books *Ecology of Wisdom* by Arne Naess and *Last Child in the Woods* by Richard Louv, I decided to focus on the earliest stages of the human-nature relationship; the childhood.

As I experienced myself, early experiences in nature are crucial in building a relationship to the natural environment. I was lucky to grow up in a semi-natural environment in the North of The Netherlands, in a village with plenty space to roam around in the forest and with parents taking me regularly out into nature for strolls in the weekend or mountain hikes during holidays. For me, nature was (and still is) a source of wonder and inspiration and a place for joy and discovery. Nature was for me a safe place, distant from the adult world or the sometimes hard realities of life. It was a place for me to be myself, without judgement of others. Moreover, nature was a place where I felt, more than anywhere else, part of the world.

While growing older, I realized how important the natural world has been in my own life and how it has contributed to my interest in and sense of responsibility for nature at later age. Arguments of Arne Naess and Richard Louv have strengthened my believes that this is not just an accidental experience I had in my life, but that it is a clear trend among children that is being threatened by our ‘modern’ industrialized, capitalistic, societies. As Richard Louv describes in his book, and as we all see around us, children spend increasingly less time in nature and more behind screens. To me this is a worrisome trend. As many studies point out, contact to nature is crucial for building relationships to nature and finally to take care of the natural world. In times of deforestation, climate change, environmental pollution, human population growth and many more environmentally threatening developments, the sign that children spend less time in nature and have less nature available to do so, is thus highly

alarming to me. Elaine Brooks stated *“People are unlikely to value what they cannot name”*. It raised the question to me: How can we reverse this trend?

Our children are crucial throughout the whole course of this story; they are not the future, as is often stated, they are *part* of the future of the Earth with all its other life forms, both as we leave it to them as how they will take responsibility of it. For a future in which not only our children and coming generations of children can flourish, but in which also all other life on Earth can be sustained, both we (all adults, including parents and teachers or other role models) and the children themselves have an important responsibility. The way we see nature, relate ourselves to nature and how we act upon this, is crucial for this future. It made me realize that if I really wanted to contribute to nature conservation by scientific research, my research should be in this field of study. And there we are; it did not only become the topic of my master thesis, but also the topic on which I wish to focus the rest of my career in one way or another.

Though many factors influence the image we have of nature and how we see our own role in this, schools may be an important place to initiate a pathway to change. Schools may both facilitate children's contact to nature, by spending more time outside, focusing on nature experiences and they may be a place for new views on the human-nature relationship to arise. This study therefore aimed to investigate the role of schools in the process of nature connectedness among children. Moreover, it gave me the opportunity to investigate the current image of nature children have, children's own relationship to nature and their environmental attitudes. It gave me important insights in the status quo of children's connection to the natural world and the way they view their own position in nature. Studying this topic for over half a year gave me both hope and new worries for the future and a lot of new ideas as starting points for further research in this crucial field of science.

Acknowledgements

First of all I would like to thank all the children that have participated in my research. The children have given me wonderful insights in their concepts of nature and their experiences in and thoughts about nature. Without these children, this thesis wouldn't be here. Specifically I want to thank my cousins Stijn, Jurre, Nine, Ymke and Silke for their willingness to participate in a test round for the focus groups. I also want to thank all the parents that gave permission to let their children participate in the research and especially those that took the time and effort to fill out the online questionnaire. The parents have provided me with valuable additional information on children's nature experiences and their home situation. Moreover I would like to thank all teachers and headmasters of the schools that have been involved, for their willingness to participate in the study while they were going through a very busy and stressful period.

Special thanks goes to my supervisors of my thesis, that have supported my ideas and have accompanied me on my journey. Prof. Dr. Matthijs Schouten has inspired me for the research in this field, by his ever interesting talks, lectures and books about images of nature. I am very honoured that he was willing to supervise my thesis externally, purely out of interest. Matthijs has stimulated me to think in a critical, philosophical way with a mind open to different perspectives. His network gave me the opportunity to involve the Nature Wise program in my study. Furthermore I want to thank my main supervisor Dr. Birgit Elands for her support and feedback, stimulating me to get the best out of my work. Moreover I'd like to praise her patience and respect at the time I had to slow down my research because of a burn-out and her endless devotion to my work.

Furthermore I want to thank all people involved in the Nature Wise programme, developed by Natuur College. Specifically I would like to thank Dr. Keelin O'Connor, who has given me the contacts for schools participating in the Nature Wise programme and who has supported my plans.

I also want to thank my good friend Femke Keeren for supporting my ideas, inspiring me by philosophical discussions and for her reflections on my work.

I want to thank my parents for showing me the wonders of nature as a kid, taking me out for weekend strolls into several nature conserves in the Netherlands and to mountains and seas during holidays. Moreover, raising me in a (for The Netherlands) semi-natural, quiet environment gave me the opportunity to discover nature on my own; (looking back) being the start of a career in nature conservation and an important personal connection to the natural environment.

Furthermore I would like to thank all the writers of books that have inspired me in forming ideas, concepts and new worldviews. Among these are Richard Louv, who's book *Last Child in the Woods* has been a major source of inspiration. The philosophical and cultural histories, theories and reflections of Arne Naess (*Ecology of Wisdom*) and Matthijs Schouten (*Spiegel van de Natuur*) have inspired me to think much deeper about nature connectedness and how this is shaped throughout different cultures. The books of Thea Beckman (*Children of mother Earth*) and Astrid Lindgren (*Seacrow Island*; *Ronja the Robber's daughter*) have reignited my own childish and playful view on the natural environment, whereas the works of Paolo Cognetti (*Eight Mountains*; *The Wild Boy*) and Arita Baaijens (*Zoektocht naar het Paradijs*) have further helped me to find my own connection to nature and a longing for more nature around me.

Lastly, I thank my yoga teachers and yoga mat, the forest, the sun, the park, my running shoes, all musicians and composers of my Spotify playlists and many more stimulating and relaxing elements

(including my coffee machine) that have helped me into flows of creative and devoted thinking and writing to make my master thesis as it is.

Nederlandse samenvatting

Steeds meer onderzoek toont aan dat natuur essentieel is voor goede fysieke, mentale en sociale ontwikkeling van kinderen. Ook zijn er sterke aanwijzingen dat positieve ervaringen in de natuur in de kindertijd, zorgen voor milieubewust gedrag op latere leeftijd. Tegelijkertijd zien we dat kinderen steeds minder tijd doorbrengen in de natuur en steeds meer achter schermen. Dit is niet alleen een bedreiging voor een gezonde ontwikkeling van onze kinderen, maar ook een bedreiging voor de toekomst van de planeet waarop wij leven. Om zowel de aarde als onze kinderen te beschermen, is het noodzakelijk om zowel onze kinderen als onszelf meer in contact te brengen met de natuur.

Eerdere studies hebben aangetoond dat op ervaring gebaseerd natuuronderwijs kan bijdragen aan meer interesse in en relatie met de natuur bij kinderen en dat dit kan bijdragen aan milieubewust gedrag. In deze studie heb ik onderzocht hoe dergelijk ervaringsgericht natuuronderwijs kan bijdragen aan verschillende aspecten van verbondenheid met natuur bij kinderen in Nederland. Daarnaast heb ik onderzocht hoe andere factoren bijdragen aan verbinding met natuur en hoe dit in verhouding staat tot het huidige natuuronderwijs. Het programma NatuurWijs is daarbij als casestudie gebruikt.

Allereerst heb ik op basis van literatuuronderzoek een theoretisch model gemaakt voor verbondenheid met natuur. Op basis van eerdere studies heb ik het begrip *Verbondenheid met Natuur* opgedeeld in drie aspecten; definiëring van natuur, emotionele relatie met de natuur en houding ten opzichte van de natuur. Onder de *definiëring van natuur* valt wat kinderen omschrijven als natuur en of ze zichzelf zien als onderdeel van de natuur. Ook omvat het begrip in bredere zin hoe de mens zich tot de natuur verhoudt. De *emotionele relatie met de natuur* omschrijft wat natuur persoonlijk voor kinderen betekent, empathie die ze voelen voor organismen in de natuur, of ze plezier hebben in de natuur en of ze een gevoel van eenheid ervaren in de natuur. Onder *houding ten opzichte van de natuur* vallen een gevoel van belang van de natuur en een gevoel van verantwoordelijkheid tegenover de natuur.

Verbondenheid met natuur hangt in belangrijke mate af van de cultuur waarin kinderen opgroeien. In het Westen heeft het Christelijke geloof en de oorsprong daarvan in belangrijke mate bepaald hoe wij de natuur zien, hoe we onszelf tot de natuur verhouden en hoe we met de natuur omgaan. Dit is de context van waaruit kinderen in Nederland opgroeien en waarop het onderwijs is gebaseerd. Hoewel de basis dus in grote mate gelijk is, hebben ouders, de school, de verdere sociale en fysieke omgeving en eigen ervaringen van kinderen invloed op de verbondenheid met natuur.

Doormiddel van focusgroep interviews ben ik met in totaal 40 kinderen uit groep 8, van 4 verschillende basisscholen in Nederland, in gesprek gegaan over hoe zij natuur definiëren, wat ze denken dat het belang is van natuur, hoe ze vinden dat we met de natuur om zouden moeten gaan en hoe ze over de natuur leren op school. Daarnaast heb ik middels een persoonlijke vragenlijst onderzocht wat hun persoonlijke relatie is met de natuur, wat hun ervaringen en gevoelens zijn in natuur en met wie ze meestal in de natuur komen. Daarnaast heb ik docenten op school geïnterviewd om een beter beeld te krijgen van het natuuronderwijs op school. Ook heb ik een online vragenlijst bij ouders afgenomen, om erachter te komen hoe zij de relatie van hun kind met de natuur zien en wat voor rol zij daar zelf in spelen. Om te onderzoeken of er verschillen zijn tussen kinderen die NatuurWijs krijgen en kinderen die regulier natuuronderwijs volgen, heb ik twee NatuurWijs scholen en twee reguliere scholen bezocht en de resultaten van deze twee groepen met elkaar vergeleken. Om te kunnen vergelijken heb ik de scholen voor ieder aspect van verbondenheid met natuur en voor alle factoren die daarop van invloed zijn een relatieve score gegeven (1-4) en op basis daarvan een

gemiddelde score berekend voor verbondenheid met natuur en voor de mate waarin omgevingsfactoren deze score beïnvloeden.

De resultaten van mijn studie laten zien dat de meeste kinderen natuur belangrijk vinden en dat ze graag in de natuur komen. De meeste kinderen vinden het leuk om in de natuur te spelen en voelen zich prettig in de natuur. Echter, weinig kinderen komen ook daadwerkelijk vaak in de natuur. Veel kinderen gamen in hun vrije tijd of spelen op iPads en telefoons. Als kinderen buiten komen, spelen ze met name in de straat of op het schoolplein en niet zozeer in de natuur, alleen als dit heel dichtbij is. Veel kinderen bezoeken de natuur wel met hun ouders, meestal in het weekend of op vakantie. Verder laten de resultaten zien dat kinderen over het algemeen een vrij mens-gedomineerd beeld hebben van de natuur. Ze definiëren natuur met name als dat wat niet door mensen is gemaakt, alhoewel ze wanneer ze over ervaringen in de natuur praten, ook parken en tuinen meetellen als natuur. Kinderen zien zichzelf niet als onderdeel van de natuur en zien de mens in zekere zin als verheven boven de natuur. Veel kinderen beredeneren dat wij door ons 'evolutionair succes' het recht hebben om de natuur voor eigen belang te gebruiken. Wel vinden alle kinderen de natuur heel belangrijk en benadrukken ze dat we voorzichtig om moeten gaan met de natuur om de aarde te behouden voor toekomstige generaties. De meeste kinderen zijn zich zeer bewust van impact van mensen op de natuur, de daarmee gepaard gaande bedreigingen voor natuur en milieu en de desastreuze gevolgen voor zowel de natuur als voor onze eigen soort. De meeste kinderen zien het belang van natuur met name voor de mens. Sommige kinderen beschrijven ook intrinsieke waarde van de natuur, maar dit is voor de meeste kinderen een vrij abstract idee. Hoewel de meeste kinderen vinden dat de mens de verantwoordelijkheid heeft om goed voor de aarde te zorgen, hebben de meeste kinderen niet zelf een gevoel van individuele verantwoordelijkheid.

Mijn resultaten laten zien dat de sociale omgeving (met name ouders) en de toegang tot natuur de belangrijkste factoren zijn die verbondenheid met natuur beïnvloeden. Het is opvallend dat kinderen die opgroeien in meer links georiënteerde gebieden, zich meer zorgen maken over milieu en klimaat en meer waarde hechten aan de natuur. Dit heeft in meer directe zin te maken met de houding van ouders ten opzichte van de natuur. Ouders van kinderen op deze scholen (Renkum, Utrecht), zijn over het algemeen zelf zeer begaan met de natuur en praten thuis met hun kinderen ook over onderwerpen als ontbossing en klimaatverandering. Ook op de scholen in deze gebieden komen deze onderwerpen meer aan bod. De invloed van de ouders op dit vlak bepaalt met name de houding van kinderen ten opzichte van de natuur (gevoel van belang en verantwoordelijkheid). De emotionele relatie met de natuur wordt daarentegen veel meer beïnvloed door eigen ervaringen in de natuur. Toegang tot de natuur (natuur in de buurt) is daarvoor essentieel. Voor kinderen van de scholen in een meer natuurlijke of landelijke omgeving (Renkum, Effen) is het veel gemakkelijker om in hun vrije tijd in de natuur te spelen. Mijn resultaten laten zien dat deze kinderen ook inderdaad meer tijd doorbrengen in de natuur, zowel in hun eigen vrije tijd als met hun ouders. Deze kinderen blijken ook meer plezier te ervaren in de natuur en een sterkere persoonlijke relatie te hebben met de natuur. Zij beschrijven bijvoorbeeld het belang van natuur voor henzelf voor gevoelens van vrijheid, rust, geluk en gezondheid.

Op basis van de berekende scores, blijken de twee NatuurWijs scholen lager te scoren op verbondenheid met natuur dan de twee reguliere scholen. Grotendeels komt dit doordat natuuronderwijs maar een heel klein onderdeel is van alles wat kinderen tijdens hun ontwikkeling beïnvloedt. De twee reguliere scholen, in Renkum en Utrecht, bleken veel hoger te scoren op factoren die verbondenheid met natuur positief beïnvloeden. Met name de invloed van ouders heeft er voor gezorgd dat deze scholen uiteindelijk hoger scoorden. Daarbij lag de school in Renkum ook in de

meeste natuurlijke omgeving van alle vier de scholen. Toch is op basis van deze uitkomsten niet te concluderen dat het NatuurWijs programma geen positief effect heeft op de kinderen. Allereerst zouden daarvoor meer scholen onderzocht moeten worden, het liefst in een verder min of meer gelijke omgeving. Ook kreeg ik gedurende het onderzoek steeds meer inzicht in het begrip *verbondenheid met natuur* en vertekening van de werkelijkheid door de manier waarop dit gebruikt wordt. Door antwoorden uit vragenlijsten en interviews werd mij duidelijk dat het begrip wellicht te veelomvattend is en met een te Westerse insteek gebruikt wordt in de wetenschap. In de huidige literatuur en ook in mijn studie, is de onze houding ten opzichte van de natuur een belangrijk onderdeel van het concept. Mijn resultaten laten echter zien dat de houding ten opzichte van de natuur niet zo zeer iets zegt over verbondenheid met natuur. Bijvoorbeeld in Utrecht scoorden kinderen hoog op belang van natuur en een gevoel van verantwoordelijkheid voor de natuur, maar kwamen ze zelf niet of nauwelijks in de natuur. Ze hadden daardoor weinig emotionele affectie met de natuur. Dit is ook op grotere schaal, met name in stedelijke gebieden vaak het geval. Uit eindelijk is juist deze emotionele, persoonlijke relatie met de natuur wat verbondenheid nu eigenlijk betekent. Uit mijn onderzoek kwam duidelijk naar voren dat daarvoor persoonlijke ervaringen in de natuur het meest van belang zijn. Zowel de ouders als de school kunnen daaraan bijdragen door contact met de natuur te faciliteren.

Om de resultaten van het onderzoek goed te kunnen interpreteren zou daarom eerst de theorie over verbondenheid met natuur opnieuw onder de loep moeten worden genomen. Ik doe hiervoor in mijn studie een voorstel. Door minder de focussen op cognitieve en normatieve aspecten binnen het begrip en juist meer op emotionele, ervaringsgerichte aspecten, komt het begrip naar mijn mening beter tot zijn recht. Het komt daarmee ook meer los van onze Westerse opvatting van natuur. Daarom stel ik voor het begrip te scheiden van de definiëring of ons beeld van de natuur, dat uit eindelijk meer de context vormt van waaruit verbondenheid ontstaat. Onze houding ten opzichte van de natuur kan ook beter los gezien worden van de verbondenheid met natuur, alhoewel de drie concepten elkaar uiteraard beïnvloeden. Verbondenheid met natuur als concept op zichzelf heeft dan veel meer ruimte voor aspecten omtrent beleving en gevoelens in de natuur en relatie met de natuur. Gevoelens van empathie en eenheid en de persoonlijke emotionele relatie met de natuur zijn aspecten die vanuit de huidige theorie ook in het nieuwe concept zouden passen. Om nog meer tot de kern van verbondenheid te komen kunnen bijvoorbeeld *existentiële intelligentie* en *intelligentie voor natuur* worden toegevoegd, begrippen die een intuïtief begrip van de natuurlijke omgeving beschrijven en het vermogen te reflecteren op de eigen plek en rol in de natuur. Daarnaast zou een begrip als *bescheidenheid of nederigheid tegenover de natuur* toegevoegd kunnen worden, om niet alleen te focussen op gevoelens van plezier en geluk in de natuur, maar ook ruimte te maken voor gevoelens van respect voor de natuur vanuit gevoelens van verontwaardiging of verwondering over de kracht van de natuur en misschien in zekere zin zelfs angst voor de natuur. Dit is met name van belang in onderzoek in niet-Westerse context.

Mijn onderzoek laat zien dat de sociale omgeving waarin kinderen opgroeien een essentiële rol speelt in niet alleen de ontwikkeling van verbondenheid met natuur, maar ook het beeld dat kinderen vormen van natuur, hoe ze zichzelf of in bredere zin de mens zien in relatie tot de natuur en hoe ze zich verhouden tot de natuur. Uiteindelijk zijn dit aspecten die de context bepalen voor verbondenheid met natuur. Ouders, scholen en andere sociale omgevingsaspecten die kinderen beïnvloeden hebben een belangrijke verantwoordelijkheid om kinderen een breed beeld mee te geven van de natuur en kinderen te laten reflecteren op het belang van de natuur en de rol van de mens in de natuur. Als we zelf niet het goede voorbeeld geven, is het onwaarschijnlijk dat kinderen op een andere manier tegen de natuur aan gaan kijken. Natuuronderwijs kan hierin een belangrijke rol spelen, zeker wanneer natuur in de thuissituatie geen belangrijk onderwerp is. Voor daadwerkelijke verbinding met de

natuur, is het essentieel dat kinderen meer in contact komen met de natuur. Natuur in de buurt is daarvoor een belangrijke voorwaarde. Ervaringsgericht natuuronderwijs kan hier aan bijdragen, vooral als kinderen opgroeien in een weinig natuurlijke omgeving. Voor meer positieve effecten van onderwijs in de natuur, is het van belang dat het gedachtegoed niet alleen tijdens de nog steeds spaarzame natuurlessen naar voren komt, maar dat het een veel groter onderdeel wordt van het onderwijs als geheel en van de sociale en fysieke omgeving waarin kinderen opgroeien. Alleen op die manier kunnen we kinderen de kans geven zich meer te verbinden met de natuur en daarmee een generatie groot te brengen met intrinsieke motivatie om de aarde en al haar levensvormen te beschermen.

Abstract

A growing body of research points at the importance of nature for children's personal and social development as well as their mental and physical well-being. Studies have also suggested that positive experiences in nature during childhood are an important predictor of environmental responsible behaviour at later age. There is however a clear trend of children spending less time outdoor and more behind screens. This trend is not only a threat for children's development and mental and physical well-being, but also for our planet. To save both our children and our planet, we should aim to reconnect children to nature.

Some studies have indicated that certain experience-based nature education programmes can improve children's connection to the natural world and in turn their environmental behaviour. In this study I investigated the effects of such an experience-based programme in The Netherlands on different aspects of nature connectedness. Schools participating in the so called Nature Wise programme were compared to schools following regular nature education. Through focus group research, open-ended questionnaires, teacher interviews and questionnaires for parents, I investigated children's nature connectedness and factors influencing it. Based on literature research, I constructed nature connectedness as encompassing three main pillars: Nature conceptualization, Emotional affinity towards nature and Environmental attitude.

The results of my study show that the effects of the nature education programmes, to extent to which they are implemented today in primary education, are very limited compared to the influence of the further socio-cultural and physical environment. In contrast to previous studies, my results show that most children have rather anthropocentric worldviews. Their images highly reflect nature images prevalent in the surrounding socio-cultural environment, including the school and the family. Children separate humans from the rest of nature and argue we can use nature for our own benefits, as long as we conserve nature sustainably for future generations. My results indicate that children who grow up in social environments where nature is an important topic, relate to somewhat more ecocentric images. Regarding emotional affinity towards nature, mainly nature accessibility plays an important role. Children who have nature around, spend more time in nature, enjoy nature more and assign more personal value to nature. My results show that most children are highly aware of environmental threats to nature, human impact on nature and that they assign great value to nature. They mainly see importance of nature for humanity. However, although they see nature as very important and see a great responsibility of humans towards nature, in general they do not show a sense of personal responsibility towards nature. Environmental attitudes are mostly influenced by attitudes and actions of parents towards nature.

An actual *felt* connection to nature seems to apply only marginally to the children. This is partly due to how the concept is used. While working with the concept of nature connectedness, I noticed that not all aspects assigned to it, do actually relate to a true sense of connection. It seems that emotional and experiential aspects come closest to its actual meaning. The concept, as used throughout literature is subject to many cognitive and normative aspects, that mostly fit in a Western setting. I suggest to revise the construct of nature connectedness, paying more attention to these actual experiential and emotional aspects at the expense of more normative, moral aspects that might say more about environmental awareness than about connectedness to nature.

Regardless of the exact definition of nature connectedness, the results of my study have once more shown that children's connection to nature highly depends on accessible nature in their direct

environments. The social environment in which children grow up shape for an important part the way children see nature and their attitude towards nature. The results of my study confirmed that parents and the further social environment, including schools, have an important responsibility in facilitating nature experiences and providing children with alternative views on the human-nature relationship. In order to improve children's connection to nature and thereby securing a sustainable future for our planet, we should start by reconsidering our own views on nature that we reflect upon our children. Schools can be an important place to accelerate a shift towards more intimate relationships to the natural world.

“Seek truth, but do not claim it.” – Arne Naess (Ecology of Wisdom, p. 17)

1. Introduction

A growing body of research suggests that childhood experiences in and engagement with nature are vital for children's development, physical health and mental well-being (Clayton, 2012; Chawla, 2015). Physical benefits include the development of a range of locomotor skills (Fjortoft, 2004) and lower obesity rates (Cleland *et al.*, 2008). Mental benefits are even more pronounced. Many studies suggest childhood nature experiences contribute to developing senses of competence, confidence, resilience, independence and problem-solving abilities (Little & Wyver, 2008). A range of studies also shows that contact with nature is associated with better attentional capacity, self-discipline, impulse control, social skills and creativity (Clayton, 2012). All vital elements for healthy development, provided by a freely accessible source: nature.

Besides direct mental and physical benefits of nature for children, many studies show that childhood experiences in and engagement with nature are an important predictor of responsible environmental behaviour at later age (e.g. Frantz & Mayer, 2014). This is an important given, since our children will be the ones that are responsible for environmental conservation in the future.

However, there is a clear trend of children spending less time in nature and more behind screens (Hofferth, 2009; Louv, 2008). Causal factors are not only the development of new technologies, but also parental fear for their children in 'wild' nature and therewith disappearance of environmental role models, reduced access to nature (especially in cities) and more time pressure on children and their families (Veitch *et al.*, 2008; Louv, 2008).

Since childhood experiences in nature are an important precursor of pro-environmental behaviour, children's loss of contact with nature not only has major implications for their mental and physical health and general development, but also can have destructive consequences for our planet. Saving our children from what Richard Louv (2008) calls the 'nature deficit disorder', would thus not only ensure children of development into healthy, socially equipped adults, it would also be an important mitigation factor in saving our planet from progressive environmental degradation.

Children's *connectedness to nature* was identified as one of the most important factors resulting in environmentally responsible behaviour both in the present and in the future (Nisbet *et al.*, 2009). Nature connectedness can be seen as an umbrella term, capturing amongst others the conceptualization of nature, emotional affinity towards nature and environmental attitude (Cheng & Monroe, 2010; Mullenbach *et al.*, 2018). It captures both cognitive, normative and expressive dimensions of nature; relating to how nature is defined, how humans and nature are (inter)related, the value(s) of nature and nature experience (Buijs *et al.*, 2011; Keulartz *et al.*, 2004; Klok, 2015). It touches upon concepts as environmental worldview and nature paradigms, nature relatedness and affinity for nature that were used in other studies (Collado *et al.*, 2016; Nisbet *et al.*, 2009; Siphthorp, 2008; Zweers, 1995). Although all concepts have their own individual differences, I argue that all are captured in the concept of nature connectedness. In my study I distinguish *conceptualization of nature*, *emotional affinity towards nature* and *environmental attitude* as the three most important pillars, covering all aspects related to nature connectedness.

Children's conceptualization of nature, their emotional affinity towards nature and their environmental attitudes are largely formed by the culture in which they grow up, but for an important part also by parental and educational influences and personal experiences with nature (Collado *et al.*, 2016; Li & Lang, 2015; van Petegem & Blicke, 2006). Other influencing factors are socio-economic status and nature accessibility (Chawla & Cushing, 2007; Cheng & Monroe, 2012).

Apart from their families, primary schools are where most children spend a major part of their time at the age at which nature paradigms are formed and connectedness to nature is established. The type of primary education children receive, the underlying philosophy and consequently the amount of contact with nature they experience during primary school years, can therefore be of major importance in building connection to nature and finally also environmental stewardship (Li & Lang, 2015).

Environmental education for primary schools, as defined by Bonnet & Williams (1998) aims to stimulate this connection to nature, through focusing on experiences rather than knowledge of the environment. However, this type of education in primary schools is still rather exceptional. In practice, environmental education often focuses on scientific knowledge rather than experiences in nature.

Since long-term nature based primary education programmes are scarce, most studies on children's connectedness to nature and environmental behaviour were either performed in out-of-class experiments, evaluating effects of short-term environmental interventions such as outdoor summer camps or specific extracurricular programmes (e.g. Mullenbach *et al.*, 2018) or with children in general (not related to specific outdoor programmes) (e.g. Bonnet & Williams, 1998; Collado *et al.*, 2016; van Petegem & Blieck, 2006). However, literature suggests that long-term nature education programmes (among which nature based primary education) work best to form lasting pro-environmental attitudes and behaviour (e.g. Manoli *et al.*, 2014; Zelezny, 1999). Studies investigating influences of long-term nature experience education as a whole on children's conceptualization of nature and connectedness to nature as a precursor of pro-environmental behaviour are rare. One study in Cyprus found that children participating in an Earth school programme showed gains in ecological understanding and more pro-environmental attitudes, values and behaviour (Manoli *et al.*, 2014). Similar results were found for Forest schools in the UK (Turtle *et al.*, 2015). Li & Lang (2015) also concluded that green schools in China are able to nurture environmentally friendly worldviews, even when corrected for parental influences.

As in other countries, schools where a major part of the education includes nature experiences, are virtually non-existent in The Netherlands. The National Forest Service of the Netherlands (Staatsbosbeheer) and Natuur College (Nature College) therefore started a programme for nature-based education on existing schools, aiming to increase children's connection to nature and finally their environmental behaviour. Their so called Nature Wise (NatuurWijs) programme aims to stimulate both the expressive, normative and cognitive dimensions of nature by triggering the 'the heart, the head and the hands': stimulating a sense of wonder about and connection to nature; learning about nature based on own experiences; and inspiring children by learning skills on how to play and live in nature and how to care for nature (NatuurWijs, n.d.). The programme started with single or multiple day nature experiences and recently launched a multiple year programme. Two studies investigated the first effects of Nature Wise and concluded that besides increased knowledge of nature, the programme stimulates enjoyment of nature, a positive attitude and a sense of responsibility towards nature (Kieviet & van Koppen, 2008; van der Waal *et al.*, 2012). The learning line for multiple years is rather new and only implemented in a few schools so far. The multiple year programme comes closest to 'nature-based education' and is therefore used in my study to investigate effects of nature experiences in primary education. Effects of the multiple year learning line were not tested yet in relation to nature connectedness as a whole.

In this study, I aim to answer the question *if and how nature experiences in primary education affect connectedness to nature among children age 11-12 at Dutch primary schools*. Connectedness to nature is subdivided into 3 pillars capturing most of its essence; *conceptualization of nature* as the basis of what is seen as nature and how humans are (inter)related to nature; *emotional affinity towards nature* capturing enjoyment of nature, empathy for its creatures and a sense of oneness; and as a last pillar

environmental attitude, a sense of responsibility for the environment. Based on existing literature, nature connectedness in the broad sense, is assumed to be a predictor of future environmental behaviour. The aim of the research is to investigate to what extent nature experiences in primary education play a role in establishing nature connectedness, apart from nature experiences outside school settings, parental influence, access to nature and further social and physical environmental influences.

The **main research question** is:

How does experience-based nature education in primary schools in The Netherlands influence children's connectedness to nature?

To answer this question, first of all, in chapter 2, I elaborate on the theoretical framework I created to come to the questions supporting my research aim. In section 3 I present the methods used to answer those questions, whereas in section 4 I provide the results of my study. To conclude, in chapter 5 I discuss my findings, relating them to theories and findings in previous research and coming up with a new theoretical basis for nature connectedness. Finally to come to conclusions in chapter 6 and recommendations in chapter 7.

2. Theoretical framework

Nature connectedness is a broad concept that can be interpreted in several manners and is used in multiple ways throughout literature. In this section, I explain how I use the concept, what it entails and how it relates to similar concepts. I also explain the concept of environmental behaviour and how this is related to nature connectedness. Finally I give a brief outline of how and why I use the concept of environmental education and how this is reflected in the Nature Wise schools I analyse in my study.

2.1 Nature connectedness

Nature connectedness encompasses several similar concepts used throughout literature, that express part of its meaning. Cheng & Monroe (2010) suggest to divide the concept of nature connectedness into 4 pillars that encompass most of its meaning. Based on a thorough literature research, they distinguish Enjoyment of Nature, Empathy for Creatures, a Sense of Oneness and a Sense of Responsibility as most important factors constituting nature connectedness. *Enjoyment of nature* entails whether children like to be in nature, whether they appreciate seeing species in nature, whether they prefer nature over non-nature surroundings and whether it makes them feel happy. *Empathy for creatures* entails the degree to which children care for non-human species in nature; whether they have an emotional relationship with elements in nature. The *sense of oneness* encompasses the feeling of being 'one' with nature and describes the view on the position of humans in nature. Finally, the *sense of responsibility* describes the view on how humans can use nature, what responsibilities we have to conserve nature and if children link human actions to environmental consequences (both positive and negative). These 4 pillars of nature connectedness form a useful framework to analyse nature connectedness in children. However, the framework doesn't encompass explicitly the *conceptualization of nature*, which I would argue, essentially forms the starting point or envelope of nature connectedness on or in which further nature connection is built.

The framework of Cheng & Monroe (2010) touches upon the three-dimensional explanation of the concept 'nature' as used by Buijs *et al.* (2011), Keulartz *et al.* (2004) and Klok (2015). They argue conceptualization of nature comes in three dimensions; a *cognitive dimension* of what nature *is*, a *normative* dimension of values we assign to nature and how humans relate to nature and an *expressive* dimension of how nature is experienced. The focus of this framework lies most on the conceptualization of nature, forming a frame of reference for nature connectedness. And whereas the framework of Cheng & Monroe (2012) focusses mainly on the normative and expressive dimension of nature, the three dimensional framework does include a cognitive dimension of what nature actually *is*.

I would argue *connectedness to nature* both depends on and largely consists of one's conceptualization of nature. They cannot be seen separately. I would argue, cognitive conceptualization of nature forms a crucial part of nature connectedness. And whereas the normative and expressive dimension of the concept nature seem to be covered quite well in the framework of Cheng & Monroe (2010), the cognitive dimension of how nature is defined might deserve some more focus. It forms the frame of reference for understanding nature connectedness; it gives an essential dimension to the understanding of what the term 'nature' in nature connectedness actually means to us. Therefore I would say nature conceptualization is the first pillar of nature connectedness.

To further integrate the two frameworks, I would suggest to add two more pillars of nature connectedness. The concepts Enjoyment of nature, Empathy for creatures and Sense of Oneness, used

by Cheng & Monroe (2012), strongly relate to the term *Emotional affinity towards nature*, that was introduced by Kals *et al.* (1999). Emotional affinity towards nature refers to feelings of joy, safety, freedom and oneness experienced in nature. One could describe it as something that comes close to love for nature (Kals *et al.*, 1999). Whereas conceptualization of nature mainly captures the cognitive dimension of nature, emotional affinity towards nature mainly captures the expressive dimension. Emotional affinity can be seen as the second pillar of nature connectedness.

As a third and last pillar of nature connectedness, I add a normative dimension to the concept. The normative dimension of nature describes how humans and nature should interact and what values we assign to (elements) in nature. It is an ethical concept that connects values to nature (Buijs *et al.*, 2011, Keulartz *et al.*, 2004 and Kloek, 2015). In many studies the term *environmental attitude* is used to capture this normative dimension (Collado *et al.*, 2016; Li & Lang, 2015; Manoli *et al.*, 2014; Mullenbach *et al.*, 2018; Wells & Lekies, 2006). It captures what Cheng & Monroe (2012) describe as Sense of Responsibility. I introduce environmental attitude as third and last pillar of nature connectedness, completing the three-dimensional construct of cognitive, normative and expressive aspects of nature connectedness (Figure 1).

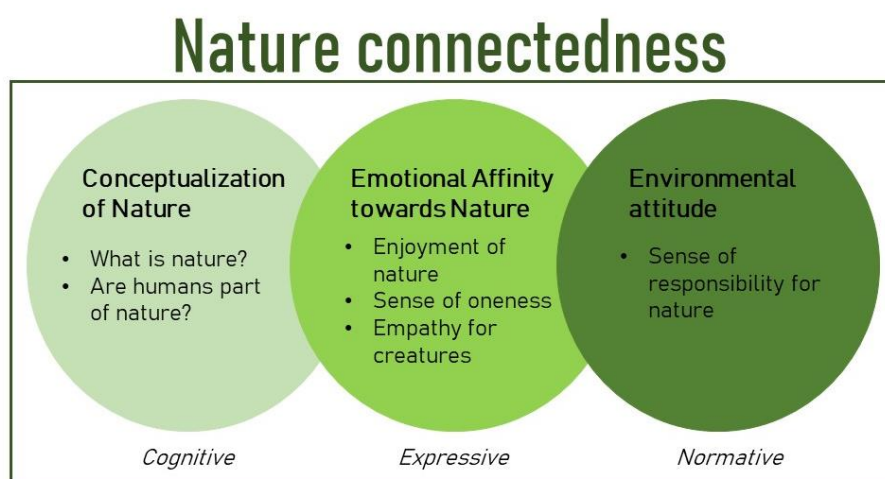


Figure 1. The three pillars of nature connectedness covering cognitive, expressive and normative dimensions of nature

2.2 Foundations of nature connectedness

2.2.1 Images of Nature and how they are formed

How we conceptualize nature and relate to nature in all its dimensions, highly depends on the culture in which we grow up and thereby the religious influences that have formed the prevailing worldviews still present today. Roots of these so called '*nature images*' lie far back in history (Buijs *et al.*, 2009; Kloek, 2015; Schouten, 2005; van Petegem & Blieck, 2006). Zweers (1995) introduced 5 types of nature images that describe images of nature in terms of the human relationship towards (the rest of) nature (table 1). This concept predominantly has a normative dimension and to a lesser extent (only in the last image) also an expressive dimension. The framework gives a clear insight in the fundamentals upon which nature connectedness is build. Though the concept is highly related to nature conceptualization, the first pillar for nature connectedness that I presented, images of nature do not

necessarily describe what nature is, but more how we relate to nature. In conceptualization of nature, both aspects are covered.

The ‘Western’ *image of nature* and how we relate to it is for a major part formed by our cultural history, going back to the ideas of Plato and Aristoteles, via ideologies of Judaism, Christianity and Islam into our current society (Schouten, 2005). Consequently, the dominant idea in Western cultures has been that nature was created for humans (image a). However, whereas in Christianity people were seen as ultimate rulers over nature, leading to the related belief that humans can use nature for their own benefits without limitations, in Judaism and Islam there was more focus on the responsibility to conserve nature for future generations (image b) (Schouten, 2013). These images explicitly separate humans from nature. They form the first 2 of 5 images of nature that were described by Zweers (1995);

Table 1. The five images of nature as described by Zweers (1995).

a.	‘Man as ruler over nature’	Nature was created for humans. Therefore humans can use natural resources and adjust nature to their own benefits without limitations.
b.	‘Man as steward of nature’	Humans stand above but do not own nature. They can use and adjust nature, but they have the responsibility to conserve natural resources for future generations.
c.	‘Man and nature as partners’	Nature and humans are at equal level, but still separated entities. Humans can use nature, but have a responsibility to conserve and restore nature. Nature also has a right to exist.
d.	‘Man as participant in nature’	Humans are part of nature, they are dependent on it for their living and cannot be separated.
e.	‘Oneness with nature’	Humans are one with nature; a feeling of oneness with the environment.

The dominant image of ‘Man as ruler over nature’, has lasted for ages in Western societies. In contrast; in Hindu and Buddhist traditions the last three images (Man and Nature as partners, Man as participant in nature and Oneness with nature) have been most dominant. However, during the last decades, many studies suggest a shift in nature images in Western countries towards the partner and participant image of nature (e.g. Schouten, 2013; van den Born, 2006). This is likely due to the loss of ecclesiastical influence, growing awareness of the role of humans in environmental problems and access to other cultures, both physically and online (Schouten, 2013).

This shifting environmental paradigm was also described by Dunlap & van Liere (1978), Dunlap *et al.*, (2000) and Manoli *et al.* (2007) as the New Environmental or Ecological Paradigm (NEP). The proposed new paradigm has a more *ecocentric* focus than the former *anthropocentric* view. It recognizes the irreversible impact humans have on ecosystems and stresses the responsibility we have to restore and conserve natural resources (Manoli *et al.*, 2007).

However, although the image of nature is argued to shift towards more ecocentrism, there seems to be a gap between our moral perceptions and our actual actions. It seems like the ‘*new biophilia*’ (nature-friendliness) as van den Born *et al.* (2011) described the shifting trend, is mainly visible in our moral beliefs about the human-nature relationship and not necessarily in how we feel or act. On the one hand, we believe we are part of nature and assign values to nature, while on the other hand we

continue to exploit nature for our own benefits. Schouten (2013) uses the term ‘schizophrenia’ for this paradox; a classic example of cognitive dissonance.

The image of nature is however not only formed by the culture in which we grow up, also personal experiences, place of residence, socio-cultural status and role models such as parents or teachers have an important influence on the development of nature images (Chawla & Cushing, 2007; Collado *et al.*, 2016; Schouten, 2013). Especially parents and teachers can therefore be important to accelerate the shift towards more ecocentric worldviews, since they have a daily influence on children (Li & Lang, 2014).

2.2.2 *Children’s connectedness to nature*

Many studies point out that most young children show a high degree of nature connectedness and that they have quite an ecocentric worldview (e.g. Boeve de Pauw & van Petegem, 2012; Bragg *et al.*, 2013; Schouten – van der Laan, 2017). However, there are differences between cultures. Boeve de Pauw & van Petegem (2012) and van Petegem & Blieck (2006) showed that Belgian children relate more to the New Environmental Paradigm than children in developing countries (Vietnam, Zimbabwe). The suggestion is that children in developing countries have a more dominant, utilitarian image of nature (Image a-b), while children in modern, Western societies see humans and nature as more equal (Image c). This is an interesting note, since children in developing countries generally live closer to nature than Belgian children, who are less directly dependent on nature. It shows the same ‘schizophrenia’ as Schouten (2013) explained; children living furthest from nature have a more romantic, ecocentric view of the human-nature relationship. I would argue that this doesn’t necessarily mean these children are more connected to nature, but simply that they can afford to have environmental concerns, because they are less directly dependent upon its resources. This argument can be related to Maslow’s pyramid of needs (1943); we first need to fulfil our physiological needs, before we can care about our environment, which is seen as a ‘luxury good’ (van Liere & Dunlap, 1980). This seems like a valid reasoning, taking into account how nature is perceived in Western societies. However, the reasoning assumes that nature is something on top of the pyramid, whereas in fact nature inevitably lies at the basis rather than the top of the pyramid. This may be another cause for our conflicting ideas versus behaviour towards nature.

Interestingly, Li & Lang (2014) showed that children (in China) have more pro-environmental attitudes than their parents. This is an effect also described in theories of *ecopsychology* that suggest that connection to nature is essentially there from the start, but that it is lost on the way due to modern societal images and behaviour (Phenice & Griffore, 2003). It supports the *biophilia hypothesis*, which states that ‘humans have an innate desire to relate to the natural world’ (Kellert & Wilson, 1993) and relates to the *deep ecology movement* (Naess, 1972), that states that “*we should see nature as children do in order to relate to the natural world*” (van der Molen & van Boeckel, 1997). In that sense; ‘restoring’ children’s connection to nature has more to do with *conservation* than with *education* (it is already there; we have to conserve rather than restore it). However, in our modern society, the educational environment seems to be essential in conservation and restoration of nature connectedness (Phenice & Griffore, 2003).

Several authors relate children’s nature connectedness to theories of attachment (Clayton *et al.*, 2012; Jordan, 2009; Louv, 2008). Jordan (2009) argues early positive experiences in nature foster a sense of relationship to the natural world, that it stimulates internalization of natural elements, the forming of an *ecological self*. It is the basis of the argument that childhood experiences in nature are crucial for

building nature connectedness (e.g. Adams & Savahl, 2015; Collado *et al.*, 2016; Louv, 2008; Postma, 2016).

Facilitating early nature experiences in primary education could play a vital role in the process of attachment to nature. I would argue that nature experiences in education open opportunities for flourishing of *naturalistic and existential intelligence*, which are often ignored in favour of linguistic and logical intelligence. Both naturalistic and existential intelligence, as described by Gardner (2000), involve relating oneself to the natural world, which is the baseline for a mature connection to the environment.

2.3 Experience-based nature education

Environmental education is proposed as a way to incorporate sustainability and nature in educational programmes as a frame of mind. Although the term environmental education is often used for a variety of education programmes touching upon nature or sustainability, the focus of the concept as defined by Bonnet & Williams (1998), is not on the scientific understanding of the natural world, but rather on the *experience* of the environment and the development of a *sense of place* in the whole. The development of environmental education in a broader sense is based on the findings of earlier research, that only increasing environmental knowledge is not enough to promote environmental attitudes and pro-environmental behaviour (Hungerford & Volk, 1990). Still, traditional nature education is usually focussed mainly on increasing knowledge rather than stimulating experiences and building relationships.

To stimulate actual nature connectedness and environmental behaviour Staatsbosbeheer (State forestry service), Natuur College ('Nature college') and the University of Utrecht (NL) started NatuurWijs ('Nature Wise'), an environmental education initiative specifically focussed on *experiencing* nature. In the full-length programme, each year in primary school, children go 3 full days out to a nature area with a trained teacher to experience nature with all the senses. Nature Wise aims to stimulate both the cognitive, the normative and the expressive dimensions of nature by triggering the 'heart, the head and the hands': stimulating a sense of wonder about and connection to nature; learning about nature based on own experiences; and inspiring children by learning skills on how to play and live in nature and how to care for nature (NatuurWijs, n.d.). The programme has a focus on the afore mentioned naturalistic and existential intelligence, that may favour nature connectedness. Two studies investigated the first effects of Nature Wise and concluded that besides increased knowledge of nature, the programme stimulates enjoyment of nature, a positive attitude and a sense of responsibility towards nature (Kieviet & van Koppen, 2008; van der Waal *et al.*, 2012). Schools that adapted the full-length Nature Wise programme are used in this study to represent schools implementing experience-based nature education.

2.4 Environmental behaviour

Assuming that significant nature experiences in primary education (such as provided in the Nature Wise programme) can increase children's connectedness to nature, the question is of course if this is also reflected in environmental behaviour, especially at later age. Although this question goes beyond the scope of my research, earlier studies found that concepts related to nature connectedness (pro-environmental attitudes, emotional affinity towards nature) indeed positively relate to pro-

environmental behaviour at later age. Wells & Lekies (2006) argue that pro-environmental attitudes act as mediator between childhood experiences in nature and adult environmentalism. Kals *et al.* (1999) found that emotional affinity towards nature, cognitive interest in nature and indignation about insufficient nature protection all directly link to willingness to protect nature and behavioural decisions concerning the environment. These factors were linked back to positive childhood experiences in nature in company of significant others.

Emotional affinity towards nature, in addition to cognitive interest in nature and indignation about collective treatments of nature, adds an essential dimension, which triggers actual care for the environment instead of ignorance about or passive awareness of environmental problems. It is the emotional attachment to the more-than-human world that creates a feeling of oneness with nature and creates awareness on our interdependency with the rest of the natural world (Jordan, 2009). Protecting the environment in that sense is thus directly protecting one's ecological self.

If environmental education could thus nurture ecocentric images of nature, emotional affinity towards nature and pro-environmental attitudes, together constituting nature connectedness, a generation of environmentalists could be built. Zelezny *et al.* (1999) showed that environmental education interventions, especially those in school settings, are indeed able to improve environmental behaviour. Moreover, Bonnett & Williams (1998) showed that environmental education does contribute to environmental concern. A more integrated study of Mullenbach *et al.* (2018) indicated that outdoor education programmes contribute to children's overall connectedness to nature. There are thus good reasons to assume that increased nature connectedness at young age through positive nature experiences, mediated by environmental education, stimulates pro-environmental behaviour at later age.

As we have seen, positive childhood experiences in nature are the basis for nature connectedness, as a mediating factor towards environmental stewardship. Apart from positive childhood experiences in nature, either in or out of school settings, Chawla & Flanders Cushing (2007) identified role models (influential family members, teachers), books, clubs, socio-economic status, gender and environmental knowledge as important influential factors contributing to environmentally responsible behaviour.

Environmental behaviour can encompass many aspects relating to environmental care. Throughout this study I refer to the definition of Kals *et al.* (1999) that explains pro-environmental behaviour (they call it environmental stewardship) as (1) Willingness to commit oneself privately (e.g. private sustainable investments) (2) Personal behavioural decisions (choosing for sustainable alternatives in daily live) (3) Willingness to show public commitment in groups (e.g. supporting collective action) (4) Behavioural decisions in public or in groups (e.g. stimulating others towards sustainable behaviour or environmental protection).

2.5 Conceptual framework

The conceptual model (Figure 2) shows how the concepts discussed in the theoretical framework are linked. *Childhood experiences in nature* are depicted as major factor influencing nature connectedness. *Nature connectedness* is captured as the interrelated concepts of nature conceptualization, emotional affinity towards nature and environmental attitude. *Nature conceptualization* in this sense mainly captures the questions; what is nature? And are humans part of that definition? Thereby the concept is slightly broader than *Images of nature*, that mainly focuses on

the human nature relationship and not necessarily on what we see as nature. However, nature images are clearly part of the concept. *Emotional affinity towards nature* encompasses *enjoyment of nature*, *sense of oneness* and *empathy for creatures*. *Environmental attitude* captures the concept *sense of responsibility*. All together nature connectedness is argued to strengthen by childhood nature experiences and forms a precursor of *pro-environmental behaviour*. The ‘evolution’ from left to right can be seen as a time path from early childhood to adulthood. External factors such as parents, culture, school, nature accessibility and socio-economic status are assumed to influence the whole process of evolving nature connectedness, mainly by shaping children’s nature experiences.

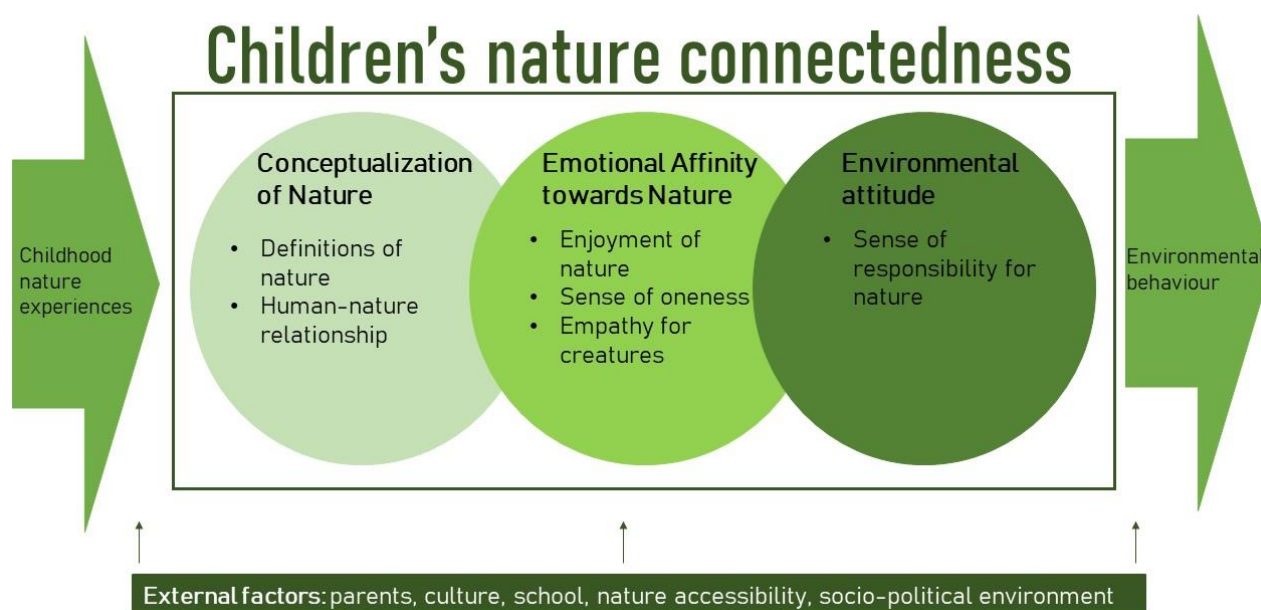


Figure 2. Conceptual framework linking childhood nature experiences to environmental behaviour through an evolving pathway of nature connectedness, captured as conceptualization of nature, emotional affinity towards nature and environmental attitude. External factors influence all concepts as a frame of reference.

2.6 Research questions

The three pillars of nature connectedness as presented in figure 1 and 2 are leading throughout my report. This framework is used to answer the following questions;

1. *How does nature experience in primary education influence children’s **conceptualization** of nature?*
2. *How does nature experience in primary education influence children’s **emotional affinity** towards nature?*
3. *How does nature experience in primary education influence children’s **environmental attitude**?*
4. *How does the influence of nature experience in primary education proportionally relate to other factors influencing children’s connectedness to nature?*

Answers to these four questions are synthesized to answer the main question that was; *How does experience-based nature education in primary schools in The Netherlands influence children’s connectedness to nature?*

3. Study design

This study combines multiple methods. Figure 3 roughly sketches the outline of the study design. To investigate children's nature connectedness in relation to nature experiences in primary education I used focus group interviews, questionnaires and interviews among children, teachers and parents of two schools participating in the Nature Wise programme and two schools not participating in the programme. The following paragraphs explain the study design in more detail.

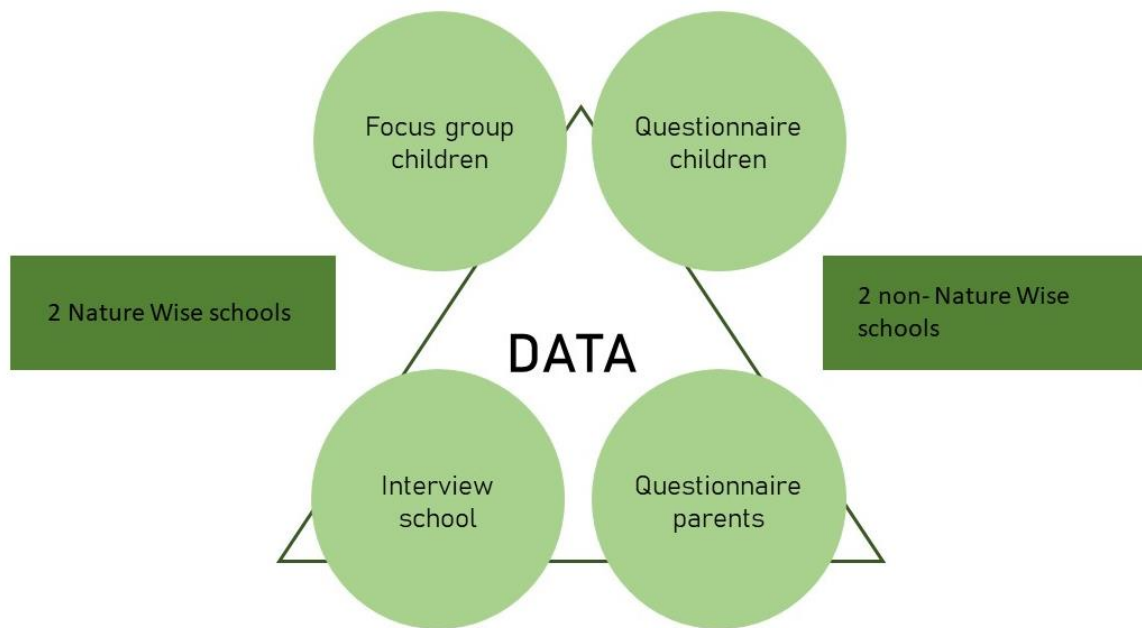


Figure 3. Schematic overview study design

3.1 Selection of schools

For the selection of schools, I took a purposive sampling approach. A purposive sampling approach allowed me to select schools based on some criteria within limited access I had to the schools. Schools were very busy, so not many were willing to join in the research or did not reply to my calls. In the end, schools are therefore rather a sample of convenience, which is also reflected in their geographical distribution (figure 4).

First of all I chose schools that implement the most extended version of the Nature Wise programme; each year the children have three full days nature experience lessons in the forest taught by a trained Nature Wise teacher. Before and after they get preparation and evaluation lessons from their own teacher at school. I found two schools near Breda (henceforth school 1 and 2) willing to participate in the research. Both schools have implemented the Nature Wise programme already for a couple of years, so the children have had multiple year experience with the programme. Both schools turned out to be Catholic schools. For comparison, I also included two schools (school 3 and 4) in my study without the Nature Wise programme. One located in Renkum (3), one located in Utrecht (4). Just like the Nature Wise schools, both of these schools also have a Catholic profile. However, in all schools the Catholic profile is hardly visible in daily lessons. All schools had some green elements in the

schoolyard (e.g. willow huts or a vegetable garden). Differences were negligible; none could be classified as a green schoolyard.



Figure 4. Geographic location of participating schools (NL)

3.1.1 Profile of schools

School 1: The school is situated in a small village South of Breda. Most children live in the village in average sized houses with small gardens. There is one small forest area close by and a bigger forest (Mastbos), a small nature reserve and a little brook at biking distance. The schoolyard has some green elements such as willow huts and trees. The school participates in the Nature Wise programme since 3 years. It fits the vision the school has for experiential education.

School 2: A very small school located in a tiny village near Breda. There are only 9 children in the 6th grade, who all participated in the research. The school was one of the first schools taking part in the Nature Wise programme several years ago. The school's vision is to let the children learn and explore from intrinsic motivation in a playful and practical way. Most of the children live in relatively big (farm)houses with big gardens in a rural area with little other houses nearby. The houses are mainly surrounded by farming fields. The Mastbos forest and a little brook are at biking distance.

School 3: The school is located in Renkum, a village at the Southern edge of the Veluwe (National Park). The village is surrounded by forest and close to a little nature reserve (brook valley). It is also at biking distance from the Rhine river with its river floodplains. Most children live in rather big houses with gardens. The school doesn't have a particular nature programme, but does organize nature excursions once up to multiple times a year.

School 4: Located in the city of Utrecht. Most children live in the direct surroundings of the school, in a neighbourhood with many small houses and apartment buildings. Some have a small garden. There are some parks in the neighbourhood. Closest nature areas are the forested estate Amelisweerd (biking distance) and the Utrechtse Heuvelrug (National Park)(car distance). The school doesn't have a particular nature programme, but does implement some nature education within a combined method for biology, geography and history. Sometimes there are lessons or excursions outside.

Table 2 gives an overview of the context of the schools. I added the results of the last political elections in The Netherlands (provincial elections 2019) to give an impression of the social environment in which children grow up. This may influence general norms and values with which children grow up. There is a clear difference in the profiles of school 1 and 2 versus school 3 and 4. Schools 1 and 2 are located in an area voting predominantly conservative, Christian, right to extreme right (VVD, CDA, FvD). On the contrary, both schools 3 and 4 are located in an area where votes are predominantly progressive, green, centre-right to left (GL, D66, VVD). Especially in Utrecht, where school 4 is located, votes are mostly green, left-wing.

Cito-scores give an impression of children's education or intelligence levels. Higher mean scores on the Cito-test, the final test for children in the 6th grade, indicate higher logical, mathematic and linguistic intelligence levels of children (on a scale 510-550). The presented scores are mean values over the last 4 years in each school (2014-2018), since scores for the current cohort of children (that I tested) were not available yet. The scores show that school 1 and 3 both score fairly high, whereas school 2 and 4 score considerably lower. Apart from indicating education or intelligence levels of the children, the scores might also say something about the general education level of parents. However, Cito-scores are just one way to measure education levels and do certainly not say everything about children's intelligence or capacity for understanding complex matter.

Table 2. Profile of schools

	School 1	School 2	School 3	School 4
Location	Ulvenhout	Effen	Renkum	Utrecht
Size (#children)	188	59	135	191
Nature education	Nature Wise	Nature Wise	Occasional excursions and outside lessons. Nature as topic in method for integrated science subjects.	Occasional excursions and outside lessons. Nature as topic in method for integrated science subjects.
Greenness surroundings homes	Average Dutch village; some green in neighbourhoods, little forest like patches.	Mainly farmland	Green environment; directly surrounded by forest, river and nature reserve.	Typical city neighbourhood; apartment buildings, many houses, little green. Some parks.
Nature around	Biking distance from medium sized forest, brook and little nature reserve.	Biking distance from medium sized forest and brook.	Part of Veluwe (national park), next to little nature reserve (brook valley), biking distance from river floodplains (developed into nature)	Biking distance from estate developed into nature, car distance from National Park Utrechtse Heuvelrug.
Political elections 2019 (top 3 parties)*	VVD: 30,7% CDA: 13,9% FvD: 12,1%	VVD: 28,3% CDA: 19,2% FvD: 13,3%	GL: 18,3% VVD: 16,8% D66: 11,4%	GL: 28,3% D66: 14,8% VVD: 12,7%
Cito scores 2014-2018**	540	533	540	530

* numbers based on results per municipality of provincial state elections 2019 (De Volkskrant, 2019). Results for Effen and Ulvenhout were specified per village (they fall in the same municipality) (mean percentages of local polls). GL (GroenLinks) = (green, left wing), D66 = centre-left, CDA = Christian, centre-right, VVD = centre-right, FvD (Forum voor Democratie) = extreme right.

** Cito is the name of the final education level test among children in the 6th grade. Higher scores indicate higher levels of intelligence and usually result in further education at a higher level in high school. Scale ranges from 510-550. The number is the mean over the past 4 years of education at the school. Unfortunately the scores for the 2018-2019 cohort were not available yet. Numbers thus say something about the general trend at the school, not necessarily about the children I tested specifically. Source: www.allecijfers.nl

3.2 Data collection

To get a clear view on nature connectedness and factors explaining this, I collected data from several sources and by different methodological approaches (triangulation). The major way of data collection were focus group interviews with children in the 6th grade (age 11-12) of schools 1-4 described in the previous paragraph. To find out more about their personal situation, experiences and beliefs I also gathered data by individual questionnaires, both for children participating in the focus group interviews and with some additional participants not taking part in the focus groups (A and B). Both

the focus group design and the children's questionnaire were tested beforehand with 3 children, age 10-12, in my family and slightly adapted afterwards to match the target audience. Additionally I interviewed teachers and/or headmasters of the schools and sent out a questionnaire to parents to find out more about contextual explaining factors for nature connectedness.

Table 3 shows how the concepts of my theoretical framework were addressed by different methodologies and data sources. Triangulation, by means of different methodological approaches (methodological triangulation) and data collection from different sources (data triangulation), not only gives a more complete view, but also helps to validate results into more reliable conclusions (Flick, 2018; ch. 13).

Table 3. Overview of data collection; nature connectedness concepts and contextual explaining factors acquired through different sources of data.

	Nature connectedness concepts	Contextual explaining factors
Focus group interview children	<ul style="list-style-type: none"> * Definitions of nature * Human-nature relationship * Enjoyment of nature * Sense of oneness * Personal importance of nature * Empathy for creatures * Sense of importance of nature * Sense of responsibility for nature 	<ul style="list-style-type: none"> * Nature accessibility * Role models * Playing outside * Nature education
Questionnaire children	<ul style="list-style-type: none"> * Definitions of nature * Human-nature relationship * Enjoyment of nature * Sense of oneness * Personal importance of nature * Empathy for creatures * Sense of importance of nature * Sense of responsibility for nature 	<ul style="list-style-type: none"> * Role models * Playing outside * Nature education
Teacher interview		<ul style="list-style-type: none"> * Nature education
Questionnaire parents	<ul style="list-style-type: none"> * Enjoyment of nature 	<ul style="list-style-type: none"> * Parents' sense of importance of nature for children * Parents' sense of responsibility for nature * Nature accessibility * Time spent outside * Nature education

3.2.1 Data description

Table 4 shortly summarizes the data collected through the focus group interviews, the children- and parents questionnaires and the interviews with teachers/headmasters. It turned out that almost all children have a Dutch nationality (1 half Indonesian, 1 half Peruvian), so cultural differences could not be tested. Gender was equally distributed (23 boys, 23 girls). Remarkably, at school 3 far more parents took part in the online questionnaire than on the other schools (11 versus 4 or 5). This was likely the result of 1 parent (being my supervisor) stimulating the other parents to participate. At schools 1 and 2

both the teacher and headmaster were interviewed, at schools 3 and 4 only the teachers. This was because the headmasters could tell me more about the Nature Wise programme and the motivations behind it. They were the ones that chose to implement it at the school. The teachers knew more about the practice of the programme.

Table 4. Data description

School	Location	Nature Wise	N focus group + questionnaire A	N questionnaire B	N questionnaire parents	N teacher interview	N headmaster interview	Girls	Boys	Total participants
1	Ulvenhout	Yes	10	5	5	1	1	8	7	22
2	Effen	Yes	9	0	4	1	1	3	6	15
3	Renkum	No	10	4	11	1	0	10	4	26
4	Utrecht	No	8	0	5	1	0	2	6	14
Total			37	9	25	4	2	23	23	77

3.2.2 Focus group interviews children

Focus group interviews were the main methodological approach to investigate nature connectedness among the children. Focus group interviews have an advantage over personal interviews for this purpose because they allow for in-depth discussions about certain topics, in which participants can interact with each other. It is a good way to explore perceptions, experiences and understandings in a group of people that you want to investigate (Kumar, 2014; p. 193). Due to group interactions, discussions in focus group interviews come closer to actual opinions, perceptions and understandings present among a group than by individual interviews (Flick, 2018; p. 255). However, a problem in focus group interviews can be that some outspoken participants dominate the discussion, whereas more reserved participants have less opportunity to express their views (Smithson, 2010). To tackle this problem, I started the focus group interviews with a short visualization exercise to make all participants feel comfortable and I tried to give all the participants the space to speak. And whereas a focus group interview is a useful tool to elucidate the beliefs of a group, it is not suitable to extract more personal views and experiences (Flick, 2018; p. 256). Therefore I combined the focus group research with personal questionnaires to ask for personal background, experiences and beliefs.

3.2.2.1 Designing the focus group interview

Questions were designed in such a way that I could infer children's conceptualizations of nature, their emotional affinity towards nature and their environmental attitudes. Moreover, I specifically asked for nature experiences in school, activities in their spare time and tried to infer information about nature accessibility and influences of role models (parents or others). Table 5 shows how the questions in the focus group interview relate to the concepts of nature connectedness. The indicators are aspects I focused on during the analysis to derive information about the concepts. The exact setup of the focus group interviews can be found in appendix 1.

Table 5. Relation between focus group interview questions and nature connectedness concepts or contextual explaining factors. Indicators show means by which concepts were used and evaluated.

Question	Nature connectedness concepts or Contextual explaining factor	Indicators
Introducing by describing home surroundings and spare time activities	<ul style="list-style-type: none"> * Nature accessibility * Playing outside * Time spent in nature 	<ul style="list-style-type: none"> * Greenness neighbourhood * Closeness parks, nature areas * Inside or outside activities * Outside activities in nature or just on the streets
Visualizing and describing a special nature experience	<ul style="list-style-type: none"> * Enjoyment of nature * Definitions of nature * Personal importance of nature * Sense of oneness * Role models 	<ul style="list-style-type: none"> * Type of nature described * Type of experience * Emotions * Values * Company
1. What would you describe as nature?	<ul style="list-style-type: none"> * Definitions of nature * Human-nature relationship * Empathy for creatures 	<ul style="list-style-type: none"> * Broadness of nature definition * Are humans part of nature? * Are humans different from other subjects in nature? * Nature associations
2. Is nature important? Why? For who or what?	<ul style="list-style-type: none"> * Human-nature relationship * Empathy for creatures * Sense of importance of nature * Sense of responsibility for nature 	<ul style="list-style-type: none"> * Is nature important at all? * Is nature only important for humans? * Are some subjects more important than others? Why? * Does nature have intrinsic value? * Instrumental or intrinsic values? * Is it fair that we use nature for our own benefits?
3. Do you learn a lot about nature at school?	<ul style="list-style-type: none"> * Nature education 	<ul style="list-style-type: none"> * Experiences * Type of education; experimental, observational, pragmatic
4. Do you sometimes take care of nature yourself?	<ul style="list-style-type: none"> * Sense of responsibility * Empathy for creatures 	<ul style="list-style-type: none"> * Types of actions * Own initiative? * Instrumental or intrinsic motivations?

3.2.2.2 *Performing the focus group interview*

In each school I performed two focus group interviews with each 4-5 children in the 6th grade (age 11-12) (N=37). Interviews took about 30 minutes and were voice recorded for analysis. I asked the teacher to form the groups beforehand, mixing gender and introvert versus extravert children. Only children of whom parents gave permission participated in the research, resulting in about 2/3 of the total number of children in the class participating in the study (except for school 2, where 9/9 children had permission to participate). All focus groups were performed in the morning, directly at the start of the school day.

I started the focus group interview by introducing myself and letting each child introduce itself by a description of the home surroundings and favourite activities to do in their spare time. This already gave me an idea of the greenness of the neighbourhoods, closeness of nature and the affinity for playing outside.

After the introduction round, I started the focus group interview with a short visualization exercise to make the children feel comfortable and to stimulate them to get to an emotional or experiential rather than a cognitive level for answering questions. I asked them to visualize a special experience in nature they ever had, visualizing both the environment, the company and how they felt at the time. I let each child describe the experience to get a feeling of what makes nature experiences memorable to them. The descriptions also gave some insight in what the children defined as nature and what emotions they experience in nature.

I posed 4 main questions as discussion points for the focus group interviews (table 4). These questions aimed to cover all pillars of nature connectedness. Based on these questions, I let the children discuss with each other, sometimes intervening with deepening questions, mainly *why* questions. I actively stimulated everybody to be involved in the discussion by asking for their opinion.

I voice recorded the focus group interviews for analysis and to avoid the necessity of making notes, since this would distract me from actively leading the discussion in a meaningful way.

3.2.3 *Questionnaire children*

In addition to the focus group interviews, I asked some more personal questions in an individual questionnaire. In these questions I aimed to find out more about their personal relationship towards nature and about factors that influence their interest in nature. This gave me a more complete view of children's connection to nature, that could not be attained only by using focus group research. All children who participated in the focus group interviews also filled out the questionnaire (version A) (N=37). In schools where I had permission for more children than could participate in the focus group interviews, I handed out a slightly more elaborated version of the questionnaire, addressing also topics discussed in the focus group (version B) (N=9). In this way more children could participate in the research. Table 6 shows which questions were asked per element of nature connectedness and the indicators used for analysis. See appendix 2 for the full questionnaire.

Table 6. Relation between questionnaire questions and nature connectedness concepts or contextual explaining factors. Indicators show means by which concepts were used and evaluated.

Question	Nature connectedness concepts or Contextual explaining factor	Indicators
Do you spend a lot of time in nature? Examples?	<ul style="list-style-type: none"> * Definitions of nature * Enjoyment of nature * <i>Playing outside</i> * <i>Time spent in nature</i> 	<ul style="list-style-type: none"> * What type of environment is considered as nature? * Inside or outside activities
With whom are you in nature most of the time?	<ul style="list-style-type: none"> * <i>Role models</i> 	<ul style="list-style-type: none"> * Is nature a personal or a social environment? * Does company influence nature experience?
Do you enjoy being in nature? What do you enjoy about it or not?	<ul style="list-style-type: none"> * Enjoyment of nature 	<ul style="list-style-type: none"> * What makes nature fun, beautiful, boring etc?
Is nature important for yourself? Why?	<ul style="list-style-type: none"> * Personal importance of nature 	<ul style="list-style-type: none"> * Emotional values
Do you learn a lot about nature at home? From whom? Examples?	<ul style="list-style-type: none"> * <i>Nature education</i> * <i>Role models</i> * <i>Parents' sense of responsibility for nature</i> * <i>Parents' sense of importance of nature</i> 	<ul style="list-style-type: none"> * Is nature experience influence by somebody at home?
Are you often in nature with somebody who can tell a lot about it? Who? Do you enjoy this?	<ul style="list-style-type: none"> * <i>Role models</i> 	<ul style="list-style-type: none"> * Inspired by somebody?
B: What is nature according to you?	<ul style="list-style-type: none"> * Definitions of nature * Human-nature relationship 	<ul style="list-style-type: none"> * Broadness of nature definition * Are humans part of nature? * Are humans different from other subjects in nature? * Nature associations
B: Is nature important? Why?	<ul style="list-style-type: none"> * Human-nature relationship * Empathy for creatures * Sense of importance of nature * Sense of responsibility for nature 	<ul style="list-style-type: none"> * Is nature important at all? * Is nature only important for humans? * Are some subjects more important than others? Why? * Does nature have intrinsic value? * Instrumental or intrinsic values?
B: Do you learn a lot about nature at school? In what kind of lessons? And do you enjoy this?	<ul style="list-style-type: none"> * <i>Nature education</i> 	<ul style="list-style-type: none"> * Experiences * Type of education; experimental, observational, pragmatic
B: Do you sometimes take care of nature yourself? What? Why?	<ul style="list-style-type: none"> * Sense of responsibility * Empathy for creatures 	<ul style="list-style-type: none"> * Types of actions * Own initiative? * Instrumental or intrinsic motivations?

3.2.4 Teacher interviews

To triangulate the data I collected from children, I performed a short interview with the teacher and/or headmaster of the school (2 headmasters, 4 teachers). In this interview I asked about the role that nature plays in the philosophy of the school and how and why nature is implemented in the curriculum. I also asked teachers how they see the children's affinity with nature and if they think activities in school influence this. These interviews gave me more insight in the contextual explaining factor *Nature education*. See appendix 3 for the exact interview questions. Interviews were voice-recorded for analysis.

3.2.5 Questionnaire parents

For extra triangulation, I also questioned some of the parents (N=25). I asked them to fill out an online questionnaire on the role of nature at home and on how they see the relation between their child and nature. In this way I tried to find out the importance of parental influence compared to influence of the school and other factors influencing nature connectedness. I specifically asked them about the time they spend in nature with their child, the estimated time the child spends in nature in his or her own spare time, if they are concerned about human impacts on nature, if they talk about nature and human impacts at home and if they involve their children in activities to take care of nature. These questions gave me inside in the contextual explaining factors *Time spent in nature*, *Playing outside*, *Parents' sense of importance of nature* and *Parents' sense of responsibility for nature*. For the exact questions see appendix 4.

3.3 Data analysis

To analyse the data I collected through the focus group discussions, questionnaires and interviews, I performed combined Thematic Coding (TC) and Qualitative Content Analysis (QCA) and applied triangulation between different sources of data. I used qualitative content analysis as described by Flick (2018); analysing the data systematically by theory-based categories set in my theoretical framework. I applied thematic coding within the QCA, further organizing information within the set categories, by sorting it using thematic codes.

I used the following steps in analysis of my data;

1. Data transcription

First of all I transcribed the voice recordings of the interviews manually. Transcripts are not strictly literal; side comments and filler words were not transcribed to stay close to the content and make the transcript more readable for analysis afterwards. Answers of the children- and parents questionnaires were entered into an excel document to use for analysis.

2. Thematic analysis

For each theme discussed in the theoretical framework (Ch. 2) I analysed all transcripts and questionnaire data anew; using a marker I highlighted all words and passages relating to a certain theme (qualitative content analysis). To these highlighted passages I applied thematic coding, sorting the information into categories within a theme (for an example see 4.2.3 on Nature Associations). For *time spent in nature* I used numeric data to make tables and diagrams. Data was

sorted per school and in some cases specified per focus group, when groups provided very different answers. I highlighted individual quotes that were either outstanding or illustrative for the group. Based on the analysed passages per theme I wrote a short description of each theme per school, giving meaning to the data.

3. *Nature connectedness score*

To be able to say something about nature connectedness, I compared the schools for each theme, ranking them per item, taking into account both focus group results and questionnaires (1 for least positive related to nature connectedness, 4 for most positively related to nature connectedness) (see appendix 5). To give a score, first of all I ranked the data based on the group descriptions and conclusions given in the focus group interview and extended these with individual answers in questionnaires, counting either positive or negative descriptions. If there was no clear distinction between schools, they got the same score. From these scores I calculated a relative 'nature connectedness score', summing the individual rankings and dividing these by the number of items (highest score; highest nature connectedness).

4. *Influence of contextual explaining factors*

For each school, I analysed the data on potential influencing factors, such as the influence of parents, access to nature and time spent in nature (combined qualitative content and thematic analysis as described in 3.6.2). Just as for children's nature connectedness, I made a ranking for these factors per school and calculated a *contextual explaining factor score* in the same way as the nature connectedness score. In this way I could see how certain contextual explaining factors relate to higher or lower nature connectedness scores.

3.4 Ethical justification

Since this research involves children as research objects and participants, I took an extra careful approach regarding ethical issues. Anonymity of all the children is guaranteed in the results. Children were not forced to take part in the focus group interview. Voice recordings were only used for the purpose of the data analysis and not shared with third parties. Before interviewing children, the parents were asked to give permission by signing an online form. By this form I also asked parents if they were open for participating in the research themselves, before I sent them the questionnaire.

Since I compared 2 groups of schools on performance on a certain measure, this may feel like a judgement. Therefore I do not mention the schools by name in my report. Schools were informed beforehand on the purpose and procedure of the research. I asked teachers and/or headmasters if they were open for some interview questions regarding the study before I interviewed them.

4. Results

In this section I present first of all the ‘contextual explaining factors’ (4.1), as such providing a meaningful context for interpretation of the results on nature connectedness (4.2-4.4). Besides *nature education at school*, the main focus in this research, these were identified as: *nature accessibility*, *playing outside*, *time spent outside*, *parents’ sense of importance of nature*, *parents’ sense of responsibility for nature* and *role models*. Within this context I present the results for the components of nature connectedness; *conceptualization of nature*, *emotional affinity towards nature* and *environmental attitude*. After discussing both the results for these contextual explaining factors and the results for pillars of nature connectedness, I present the calculated ‘nature connectedness scores’ (4.5) and ‘contextual explaining factors’ scores’ (4.6) and then link these to each other and further interpret the found results in paragraph 4.7.

4.1. Contextual explaining factors

The contextual explaining factors form important factors that may either positively or negatively influence children’s nature connectedness. I present the results for these factors beforehand, because they give an important frame for interpreting the results on nature connectedness in the following paragraphs.

4.1.1. *Nature education at school*

Although only two of the schools (1 and 2) participate in the Nature Wise programme, all schools implement nature education to a certain extent in their curriculum. For the Nature Wise schools, the programme is the major source for nature education. Schools 3 and 4 sometimes do external activities in nature or discuss topics in class, but on a far less regular basis. It also depends on the interest of the teacher, if children receive nature education. Apart from nature education at school, I asked children whether they learn about nature at home or in some other way. In the following section I describe how nature education is organized and experienced at each school and at home, seen from the perspective of headmasters, teachers, parents and children.

School 1: Since 3 years the school participates in Nature Wise. The school director brought the programme to the school, because she had a positive experience with the programme at a previous school (school 2). It fits the vision of the school on explorative learning. She says; “*if we really want explorative learning, Nature Wise is the way to go*”. She chose for the full 3-day-a-year programme to have a covering education programme. Although both the teachers and the pupils were somewhat sceptic at first hand, she thinks the programme has now been embraced by the school. She sees the Nature Wise programme as essential to really experience and relate to nature: “*nature shouldn’t only be read about in a booklet, but should be seen, tasted, felt*”. She is convinced that knowledge about nature also lasts longer in this way. Apart from the Nature Wise days, the school sometimes participates in clean-up days, but Nature Wise is the most important source of nature education.

Also the teacher is convinced the Nature Wise programme helps to get the children more connected to nature. She sees most children enjoying these days. However, she also mentions; “*the younger children in de first grade like everything, the 6th graders have to be motivated more*”.

Most parents think the school helps in stimulating interest in nature by the Nature Wise programme: *“since they know more about it, it becomes more interesting”*. Some don’t think the school plays a role in children’s interest for nature or are not sure about it.

Remarkably, when I asked the children if they learn about nature at school, most of them say they don’t learn much about it. They mention the Nature Wise days at school, but say they don’t like it and that they don’t learn much from it. Most say every Nature Wise day is the same and that it is very boring. It turns out that they mainly don’t like the Nature Wise teacher. Others say; *“I just don’t care about nature”*. Some would like to learn more about nature and to go more to nature with school if they would have a different teacher and if there would be more variety in the days. On the other hand, when asked from whom they learn most about nature, most children mention the Nature Wise day teacher.

Most children say they don’t learn about nature at home. One says; *“I learn from Youtube”*. One boy says he learns about plants and animals when he goes for a walk in nature with his parents.

School 2: The school participates since approximately 10 years in the Nature Wise programme, as one of the first schools in The Netherlands. It fits the vision of the school on learning by experience and stimulating intrinsic motivation; the location coordinator states *“learning about nature is best in nature”*. She also explains the Nature Wise days are always special days on which children not only learn about nature, but it also helps in socio-emotional development and stimulates group dynamics. However, the preparation and evaluation lessons at school could have somewhat more body.

The class teacher is more sceptic about the programme. He isn’t convinced about the effectiveness of the programme; he does see the children like to go outside with the Nature Wise teacher and to play in nature, but isn’t sure if they learn enough. It is also hard for many children to stay focussed outside. Also, there is quite some difference between the Nature Wise teachers; some teach very good lessons, including preparation and evaluation. Others only focus on the days outside and don’t provide support lessons.

Most parents see their children learn to appreciate nature by what they learn at school in the Nature Wise programme: *“The three Nature Wise days certainly stimulate the interest in nature”* One father is more sceptic and says the study material is incorrect.

The children themselves say that the Nature Wise day is the major way nature is addressed in the education programme. Most children like the Nature Wise day because they can play a lot. However, most say that they do not learn a lot during those days and that the days are too similar each time. Though, most children mention the Nature Wise day teacher as the person from whom they learn most about nature. Some also learn about nature at home from their (grand)parents or from television (Freek Vonk, nature programmes). One girl says; *“usually I am the one that knows most about nature, especially about animals”*.

School 3: There is no specific programme for nature, but as the teacher explains, every year there are some activities outside. Children learn about the history of the landscape for example. Usually there are lessons from the nearby visitors centre. Sometimes nature activities are coupled to expression assignments. Subsidy for nature lessons gets less though. Still, the teacher sees nature education as part of the study program; *“We live in nature, it is part of our lives, thus nature is naturally part of our education.”* It depends on the teacher and on the activity whether the children like it or not. They like to do something rather than to listen only. Most just like being outside, some are actually interested.

Many parents say they think the school has a positive influence on the interest of the children in nature. They regularly hear enthusiastic stories about excursions to the forest/brook valley/visitors centre. Also the parents indicate that the children talk about nature topics that were discussed at school: *“at school awareness and opinions about many topics are formed, including nature”*. Some mention the activities in the school garden. Though, some say the influence of the parents themselves and the news is more important in stimulating interest in nature than influence of the school. One states that there is no influence of the school at all. Some say they would like more outside nature education at school.

The children mention they don't learn much about nature at school. There is one subject (Nature and Techniques) in which they learn about nature topics, such as historic and foreign landscapes, environment and agriculture (*“but that is really the only thing”*). Sometimes they do crafting with things they found in nature or they do a photo project. Sometimes they go outside for a lesson in the forest. Also they participate with school in clean-up days. Some children made a school vegetable garden (*“but now it is completely overgrown”*). They would like to have more lessons outside (*“but then to do something, not to do an assignment and to write things down”*).

Most children say they learn sometimes about nature at home (from parents or grandparents). For example to be careful with nature and not to leave trash and things about birds and (edible) plants. Some mention they don't learn about nature from anybody. One child learns about nature at the scouting club. One says; *“I learn about nature in the garden centre”*.

School 4: Nature and sustainability are part of the education programme. For example in the integrated method for history, biology, geography and self-development (4 times wiser). Sometimes the children do activities outside, such as building huts. Once in a while there is a lesson in the forest or at a farm, depending on the teacher and on specific offers. The school also visits the university museum to learn about natural history. Teachers can choose to work with lesson toolkits regarding a certain topic. These also include nature topics. They also participate in clean-up days and recently in an e-waste event. The teacher thinks it is very important that the children learn about nature at school; *“some children never visit nature, so it is important to provide this at least at school”*. She sees a big difference between children that are used to play in nature and children that never visit nature; *“some children climb the trees, others are scared”*. In her opinion it is very important that the children learn about the importance of nature and about sustainability (*“it is important for the bigger picture”*).

All parents think the school plays an important role in stimulating interest in nature. The topics that are discussed at school make the children think about it and they get enthusiastic when they have lessons in nature. As a specific example one of the parents mentions the e-waste competition that the school almost won; it made all children very involved in sustainability.

The children have to think for some time about the question whether they learn about nature at school. Most say they learn every now and then about nature in the 4 times wiser method. Sometimes they have lessons outside in the schoolyard, but not often really in nature. They also built huts for a nature lesson. Moreover, they mention the e-waste race they almost won. Most children would like to have more lessons in nature, but not for learning too much, mainly for doing things and playing outside.

Most children say they don't learn much about nature at home. One learns from the television. One mentions he learns from his parents for example not to leave trash in nature.

4.1.2. Nature accessibility

Whereas children of school 3 basically live surrounded by nature (Veluwe, Rhine river, brook valleys), for the other schools nature is not as close by. For children at school 3 the surrounding nature is part of their daily living space; they play here, bike through or go for a walk with the dog. Most children at school 2 also have quite some outside space surrounding their homes (but not necessarily nature), since most of them live in a rural area with mainly farmer fields. Both school 1 and 2 have a forested area (Mastbos) and little streams close by, but not around the corner. Most children do not visit these places themselves. Children at school 4 have least direct nature in their surroundings. They live in a medium sized city in a neighbourhood with many apartment buildings and houses. There are some parks, but the closest nature area is Amelisweerd (bike distance) or the forested hill area next to Utrecht (Utrechtse Heuvelrug). They do not come in both these places by themselves.

4.1.3. Playing outside

At the start of the focus group interview I asked the children what they prefer to do in their spare time. This gave me some insight in the enjoyment of playing outside (not necessarily playing in nature). Most children at school 2 and 4 prefer gaming in their spare time. Some children rather like to play outside. At school 1 and especially school 3 more children mention they prefer to play outside. Inside children mostly play on their phones (Youtube, Instagram, Snapchat) or on PlayStations. Outside it is mainly soccer, but also jumping the trampoline, longboarding or other sports activities.

4.1.4. Time spent in nature

Based on the estimation of parents, a remarkable part of the children (40%) spent less than 3 hours a week in nature¹ in their spare time. About a quarter of the children (resp. 28% and 24%) spent 3-7 or 7-14 hours a week outside/in nature. 2 children (8%) spent more than 14 hours outside/in nature in their spare time. Most parents (46%) spent 0,5-2 days per month in nature with their children. Both 21% spent either 2-5 days or more than 5 days per month with their child in nature. 3 parents (13%) spent less than half a day with their child in nature. Overall this results in 65% of the children coming very little or sometimes (<3-7h a week self and or <0,5-2 days/month with parents) and 35% coming often or very often in nature (7->14 h/week self and/or 2->5 days/month with parents) (figure 5).

¹ A remarkable part of the respondents (both parents and children) define every outdoor activity as being in nature. Some parents make a distinction in playing outside in the neighbourhood and being in nature.

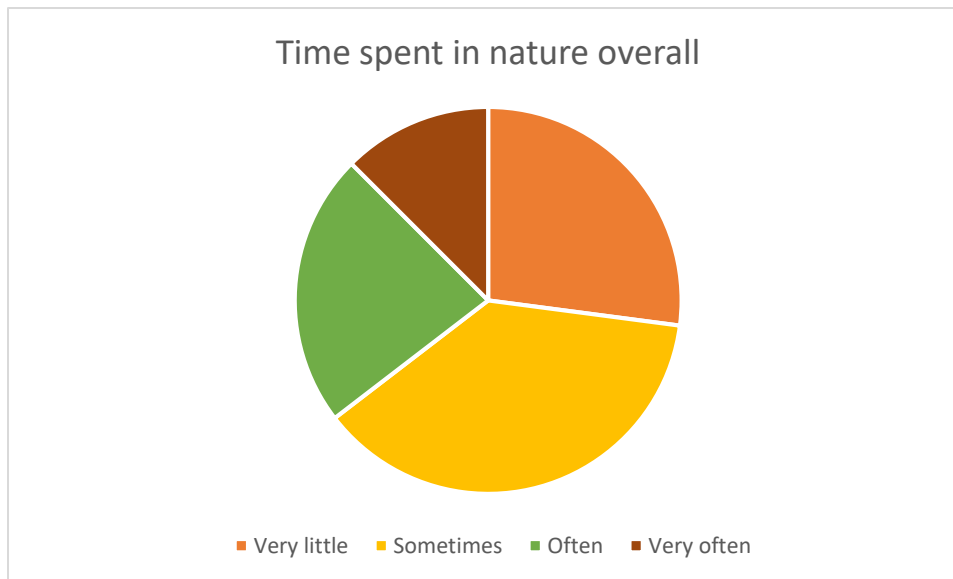


Figure 5. Time spent in nature overall. Very little = <3 h/week self and/or <0,5 days/month with parents, Sometimes=3-7 h/week self and/or 0,5-2 days/month with parents, Often=7-14 h/week self and/or 2-5 days/month with parents, Very often=>14 h/week self and/or >5 days/month with parents. Note that 'nature' is often defined as 'outside'.

Based on the data, children of school 3 spend most time in nature, both with their parents and in their own spare time. These children live in a forested area (South-West Veluwe) and thus have nature close by. They go mostly walking (with or without dog) and biking in surrounding nature areas or hike during holidays with their parents. Some parents also play with their children outside or do gardening together. One of the parents says her child often goes to a field with animals to watch them and to talk to them. In their own spare time the children mostly play outside or walk the dog with friends or family. They do this in forests, brook valleys, river floodplains or just in the neighbourhood. Reasons that children don't visit nature are amongst others the attraction of the Iphone and playstation. One parent mentions they took their child more into nature when she was younger, but now she decides more for herself what to do with her spare time (resulting in less time in nature).

Also children of school 2 spend quite some time in nature. Parents indicate they practically live in nature, so when the children play outside they are automatically in nature. Also most families have big gardens where children play or help with gardening. They don't go that often with their child to other nature areas than just the surroundings of their homes. Most children and parents also indicate the children spend a lot of their own time in nature, mainly for playing, petting animals, scouting, gardening or walking the dog. Some children say they come rarely in nature. One boy mentions: *"I am in nature during the Nature Wise day at school, but not often by myself."*

Children of schools 1 and 4 spend least time in nature. Most parents of children in school 4 indicate they mostly spend time in nature during holidays in foreign countries. Some of the children play outside a lot, but not necessarily in nature since they live in a city with little nature in the direct surroundings. Sometimes they go biking or hiking in nature when the weather is good. Taking into account both children and parents' responses, most children of school 1 almost never visit nature (64%). Some children go for walking or biking trips with their parents during the weekend or during holidays. Some children play outside, but not necessarily in nature. Some children indicate they only visit nature during the Nature Wise day at school or when they walk the dog. Only a few children spend part of their own time in nature for fishing or building huts.

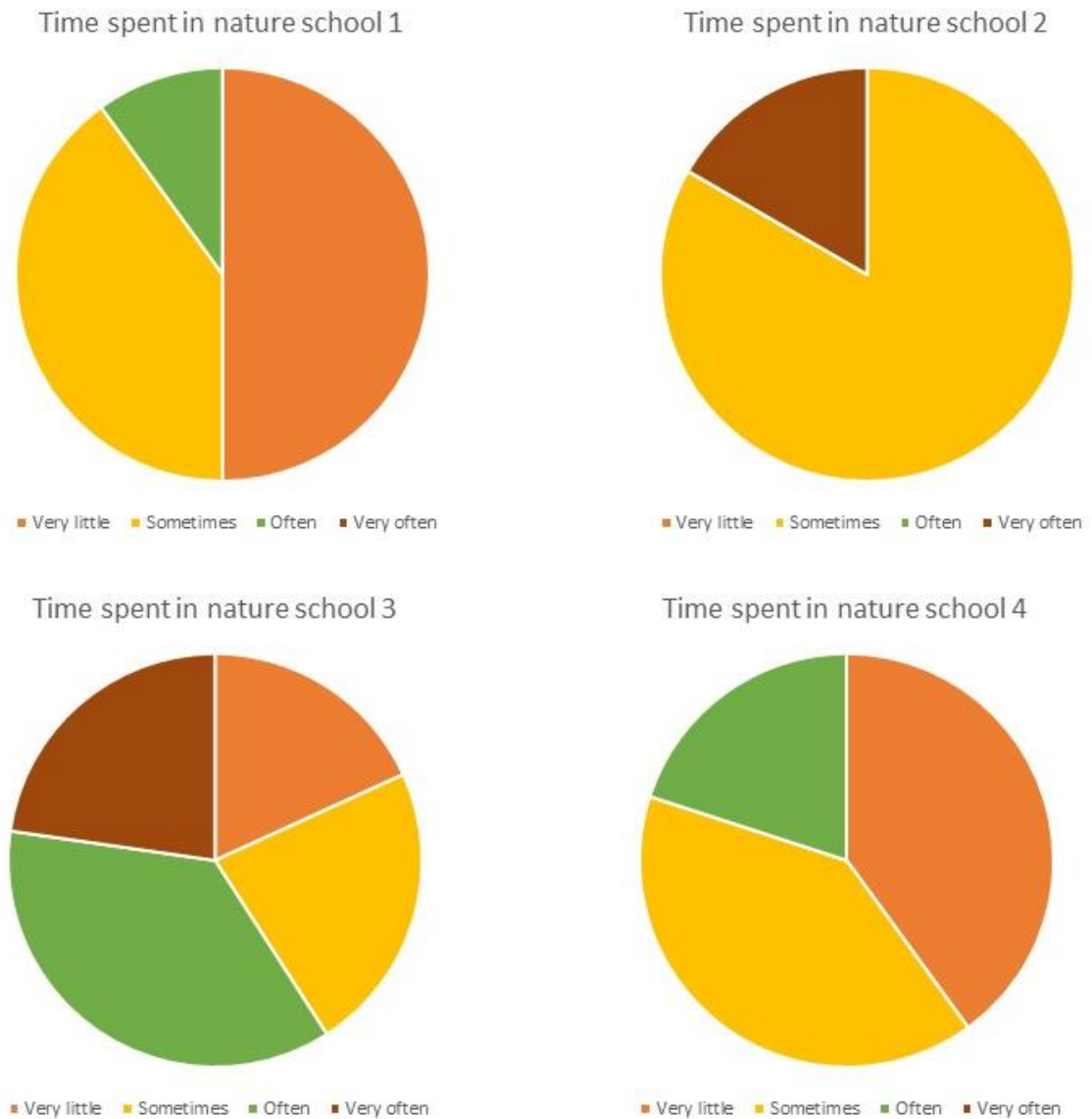


Figure 6. Overall time spent in nature per school. *Very little* = <3 h/week self and/or <0,5 days/month with parents, *Sometimes*=3-7 h/week self and/or 0,5-2 days/month with parents, *Often*=7-14 h/week self and/or 2-5 days/month with parents, *Very often*=>14 h/week self and/or >5 days/month with parents. Note that 'nature' is often defined as 'outside'.

4.1.5. Parents' sense of importance of nature for children

In the questionnaire I asked parents whether they think nature is important for their children and if they actively take their children out into nature or stimulate them to go out themselves. This gave me an insight in the incentives children receive from home to care about nature. Most parents take their children out into nature mainly for social reasons: being together as a family, talking to each other; spending some offline time with each other. Also health reasons are an important motivation to go outside or to stimulate their children to play outside. Some parents take their children into nature to show them the beauty or to create awareness about the value of nature. Some parents are somewhat reluctant to stimulate their children to go outside because they find it dangerous for children alone in nature, because of certain insects (in this case oak processionary caterpillar), because children have a

full program already or because they don't want to push their children in order to prevent aversion against nature.

It differs per school why or why not parents think nature is important for their children, if they take their children out into nature and to what extent they actively stimulate their children to visit nature (table 7). Parents of children in school 3 most clearly state their sense of importance of nature for their children. All of the parents consider it as very important to take their child into nature, not only for health and social reasons, but also to stress its importance, for sparking a sense of wonder, a sense of place and a sense of oneness. Also at school 2 some parents mention some more existential reasons such as broadening the perspective on life. Parents at school 4 mention mainly social and health reasons. They don't take their children a lot out into nature or stimulate them to go by themselves, mainly because there is no nature around the corner. At school 1, least parents actively stimulate their children to go out into nature or take the children with them to nature areas. Though, they do see importance of nature for children, mainly for social and health reasons.

Table 7. Parents' view on importance of nature for their children and active stimulation to go outside.

School	Parents' sense of importance of nature for children
1	Most parents consider it as important to take their child into nature. Mainly for social reasons (being together as a family), for fun, just practical (to walk the dog) or for health reasons (rest, general health). Most parents do not actively stimulate their children to go outside (for example because they have too many other activities to do). One parent does actively stimulate his or her child to go outside because it is healthy.
2	All parents consider it as important to take their children out into nature, to stimulate awareness about nature, to learn about nature and to develop a broad view on life or for health reasons (healthy brains, relaxing, no screens). For the same reasons, the parents also stimulate their children to go outside themselves. One parent mentions she is a bit reluctant at the moment because of the oak processionary caterpillar.
3	All parents consider it as important to take their child into nature; to show them the beauty of nature, to spark a sense of wonder, a sense of place and a sense of oneness; to show the importance of nature (valuing nature, conservation); for health reasons (preventing screen use, exercising, relaxing) and for social reasons (being together, having good conversations). Most parents stimulate their children to go out into nature for similar reasons. Some parents don't stimulate their children to go outside because there are too many other activities to do or they don't have time themselves, because the children go themselves already or because they don't want to cause aversion against nature by being too pushy.
4	All parents consider it as important to take their children out into nature. Most important reasons are for health (exercising, being outside, relaxing), social reasons (talking to each other, being together), to experience, to explore and to enjoy. One parent says: <i>"We take our children into nature to spend some offline time with each other"</i> Some parents actively stimulate their child to go out into nature, mainly to exercise. However, one parent mentions it is difficult since nature is not close to where they live. Another says she has fear to send her boy to the forest on his own.

4.1.6. Parents' sense of responsibility

To gather more information on the sense of responsibility for nature children grow up with at home, I asked parents' whether human impact on nature is an important topic at home; if they talk with their children about nature and human impact on it, if they involve their children in measures for biodiversity or the climate and why or why not. Most parents do worry about the state of nature, about climate change and about human impact on the environment. Most parents do talk about this with their children, often related to topics discussed in the news or at school. Sometimes children bring the subjects up themselves. Some parents don't pay attention to this at home, either because it doesn't interest them or they don't believe in it, or to protect children from heavy matter going on in the world. Apart from talking about it, some parents actively do something to take responsibility for nature and some involve their children in it.

It differs quite a bit per school to what extent parents discuss human impact on nature with their children and whether they involve them in actions (table 8). At school 1 parents seem least worried about human impact on nature. Some do talk about it with their children at home, while for others it is not really a subject of interest. At school 2 there is more divergence; some parents do not really believe in certain human impacts on the climate or on biodiversity, while others worry about it. Most of the parents talk about it with their children to make them aware of these subjects, or children bring it up themselves. Both at schools 3 and 4 all parents explicitly state their concerns about human impacts on nature and talk about this with their children. Parents of the children in school 3 describe their worries most extensively and mention a very broad range of effects of humans on the planet. They seem to be most aware and actively handling upon this awareness.

4.1.7. Role models

In the questionnaire I asked the children whether there is somebody that often takes them to nature or that can tell a lot about it; from whom do they learn about nature? Are role models important? Most children at school 1 and 2 mention the Nature Wise day teacher as the person from whom they learn most about nature. However, especially at school 1 they don't necessarily like the teacher. At both schools, some say they don't learn about nature from anybody at all and some are mainly taught by television (Freek Vonk or other nature programs, or Youtube). At school 2 some children indicate they also learn from there (grand)parents. At school 4, most children state they don't learn about nature from anybody at all, only some mention their parents or television/Youtube. Most children at school 3 learn about nature from their (grand)parents, in some cases from a forester during a school excursion, from scouting or from television/Youtube.

Table 8. Degree to which parents worry about nature, talk about it with their children, act upon it and involve their children in this.

School	Parents' sense of responsibility
1	Some parents worry about nature and the human impact on nature. They worry about the loss of nature. Some say they do not really worry, at least not locally, only on a global scale. One parent mentions; <i>"No worries for us; we live in a beautiful natural environment"</i> . Some of the parents do talk with their children about human impact on nature, mostly based on news items. Some parents don't do it. One states; <i>"it just doesn't interest me"</i> .
2	Most parents do worry about nature and human impact on nature. They worry mainly about loss of nature, trash, pests and pesticides. One parent sees climate change not necessarily as a consequence of human impact; <i>"climate extremes are of all times"</i> . One parent does not worry about nature, but about agriculture; he sees a threat of nature development for agriculture. Most parents do talk with their children about human impact on nature to make them aware of it. Some children bring up the subject themselves.
3	All parents are very much aware of the threats of human impact on nature. They worry about climate change (<i>"Climate change is a worrisome development for the future of our children"</i>), pollution, invasive exotic species, pesticide use, loss of nature, drought and disturbance of ecological balance. They mention human egoism and the economy as main threatening factors; <i>"We disturb nature by our presence, pollution and interference"</i> , <i>"Humans don't have respect for nature"</i> , <i>"Humans are a pest"</i> , <i>"We only think about ourselves, at the expense of the others animals and plants on this earth"</i> , <i>"Nature is being outweighed by economics"</i> . One parent doesn't have worries, but states it is important to be aware of our impact and the importance of nature. All parents talk with their children about human impact on nature. Many children also come up with questions, bring up subjects themselves or give presentations about it at school. Often parents talk about subjects when they appear in the news or when they are handled in school. Some parents involve their children in solutions; for example making the garden a better place for biodiversity and separating garbage. They mostly talk about climate change, threatened animals, food waste, energy use and pollution with their children. One parent mentions she avoids some subjects because they are too heavy for a child under the age of 12. She focusses on pollution, energy use and food waste that they can directly handle upon.
4	All parents state they worry about nature and the human impact on nature (<i>"Human impact is huge and visible"</i> , <i>"Nature suffers from our lifestyles"</i>). Parents are mainly worried about climate change, plastic, air pollution by exhaust gases, the future and the health of the planet, the animals and ourselves. All parents talk with their children about human impact on nature, often based on news items or subjects discussed at school. Some involve their children in mitigation measures such as water and energy saving, separating garbage, picking up trash and by inspiring them for innovative solutions. One parent states she doesn't talk too much about human impact on nature, because the children get scared and depressed from these stories.

4.2. Nature conceptualization

To describe the conceptualization of nature among children in the different schools, I present here the *definitions of nature* that children came up with, their descriptions of the *human-nature relationship* and additionally *associations* they have with the word ‘nature’.

4.2.1. Definitions of nature

Children came up with a wide variety of nature definitions. Plants and (non-human) animals were part of all definitions. Most groups mentioned trees, grass and forest as a first description of nature. All groups made a difference between humans and non-human animals. Some defined humans as part of nature, others did not. Interestingly, some argued humans were part of nature in the past, but not anymore. Most groups excluded elements that were made by humans. Parks, gardens and pets were often subject for discussion. Besides living elements, many groups also included non-living elements such as oxygen, rocks, water, air, the sun and sometimes even the universe. One girl (school 3) that did not take part in the focus group interviews, but only in the questionnaire, defined nature very catching as: “*Nature forms the lungs of the Earth*”. The other children taking part in questionnaire B, interpreted the question on what nature is differently and gave answers like “*nature is beautiful*” or “*important*”. Apparently the question was not clear. Therefore the answers from the questionnaire were not taken into account for this question.

Since all definitions that came up during the focus group interviews are declarative and potentially characteristic for the current generation of children, I give them all (Table 9). Although the definitions of nature vary between groups, no clear difference in inclusiveness of the nature descriptions can be seen between schools. Therefore, the nature definitions were given the same scores on nature connectedness.

Table 9. Definitions of nature given by children participating in focus group interviews (2 focus groups per school)

Group	Definition of Nature
1.1	<i>Nature are living organisms that we do not take care of.</i> Water and air also belong to nature; animals live in water and air comes from trees. They think especially of forests, trees and animals.
1.2	<i>Nature is not human made.</i> This includes plants, animals, water, sand, oxygen and even the universe but not parks and gardens. Technically speaking, humans do also belong to nature, but they are more enemies of nature than part of nature.
2.1	<i>Nature is where there is no electricity and wifi.</i> There can be 4G though. Humans are also nature, since we are mammals. Parks and gardens aren't nature; nature creates itself and parks and gardens are created by us. And whereas water and the sun are identified as nature, the moon and the universe are assumed to be no nature.
2.2	<i>Nature is everything that lives, including humans.</i> Especially where there is green; trees and grass. Water and other planets also belong to nature. Parks, gardens and lawns are also nature, since there are trees and grass. But where there are a lot of houses and roads it isn't nature anymore.
3.1	Basically <i>everything is nature, except for humans</i> . If humans were not there, the whole world was still nature. Humans did belong to nature in the past, but not anymore. The group also includes rocks, caves, sun, rain, air, clouds, oxygen and CO ₂ . They think of a variety of landscapes including hills, shrubbery, forests, brook valleys, rivers, river floodplains, sea, lakes and rain forests. When talking about animals they include not only terrestrial species, but also talk about sea life.
3.2	Basically <i>everything is nature, the whole world</i> . But humans belong partly to nature. In the past humans lived in nature, now humans and nature are more separated. They talk about both terrestrial and aquatic animal species and describe a range of nature areas including forests, mountains, jungle, rivers, swamps rain forest and brook valleys. Caves, waterfalls and mud are also included.
4.1	<i>Everything is nature</i> , including the universe, water and humans. But things made by humans are not nature. Nature areas they think of are forests, islands, the North sea, parks and shrubberies.
4.2	<i>Nature is everything that is not made by humans</i> ; plants animals, water, stones. However, planted trees can also be included in the definition of nature. Humans aren't part of nature.

4.2.2. Human-nature relationship

Most groups see humans and the rest of nature at first glance as separated entities; they don't think about humans while describing nature (except for 1 group at school 4). After some reasoning, some groups conclude humans are actually part of nature (since we are also animals). Some describe how humans were part of nature in the past, but not anymore; we got distanced from nature by living in houses and using electronics. Many children describe the human-nature relationship as a relationship between enemies: humans abuse nature, and nature hates humans. Most children see humans as superior to the rest of nature, "since we evolved as the smartest creatures". Therefore most children

state humans have the right to use nature for their own benefits, but not limitless; we should respect nature and use it only for good things. Strikingly, multiple children describe some sort of reciprocal relationship between humans and nature in the sense that nature gives us food, oxygen and energy and that “*we give CO₂ back that helps them grow*”. However, one girl (school 3) states that trees are actually more important than humans; “*they give us life*”. Although all descriptions are rather anthropocentric, some slight differences can be observed. Overall, school 1 and 2 give slightly more anthropocentric, utilitarian descriptions of the human-nature relationship, whereas the descriptions of schools 3 and 4 have some more ecocentric elements (table 10).

Table 10. Descriptions of the human-nature relationship per school

School	Description of human nature relationship
1	Nature and humans are more like enemies than like partners. “ <i>Humans use nature, but nature does not use humans</i> ”. “ <i>Nature hates humans</i> .” Still, nature is vital for humans, since trees produce oxygen. Though, humans are the smartest creatures and know how to use nature for their own benefits. The boys therefore reason we have gained the right to do so without regret. The girls argue it is not fair how humans use nature, since “ <i>nature does so much for us and we only abuse nature</i> ”.
2	Humans evolve from nature and cannot do without it. However, nature let humans evolve as the smartest creatures, the only ones knowing how to control nature. Therefore it is legitimate to use nature for our own benefits; but only for good purposes. We cannot abuse nature. A boy also sees a reciprocal aspect; “ <i>humans expire CO₂ which makes trees grow</i> .”
3	In the past, humans and nature were one, but not anymore. At least not the modern, western people; ‘wild savages’ are still part of nature. The group describes aspects of a reciprocal relationship; nature provides us with food, oxygen and energy and in turn “ <i>we provide trees with CO₂, which helps them to grow</i> ”. The group also describes the human-nature relationship as one between enemies. A girl states: “ <i>Humans have become too smart, which made them become enemies of nature</i> .” This is not how it should be. “ <i>We destroy everything</i> ”. A girl states that trees are actually more important than humans, since they give us life. “ <i>Trees should therefore have more rights than humans</i> .”
4	Part of the group does think about humans when describing nature; humans are mammals. However, humans are smarter and have learned to write, to talk, to use techniques. To some extent some animals have also gained some of these qualities (such as beavers building dams and apes using their own language), but they see humans as superior in this sense. This also made humans abusing nature, which isn’t fair. Another part of the group states; “ <i>humans are too lazy to be nature</i> ”. In the past humans were part of nature; we hunted for food and lived in nature, but nowadays we live in houses, use electronics and only abuse nature. “ <i>Humans are too indifferent to take care of nature</i> ”.

4.2.3. Nature associations

Children associate a wide variety of activities, words, elements and other things with nature, that were not all captured in the given definitions of nature or the descriptions of the human-nature relationship (table 11). All groups immediately thinks of **things to do in nature** (or outside): *sports* such as soccer,

hockey, jumping the trampoline, longboarding, biking and swimming (in swimming pools) (sports that are not necessarily performed in a natural setting); *outdoor sports* such as walking, hiking, mountain biking, skiing, diving, canoeing and swimming (in lakes/rivers); *nature activities* such as building huts, fishing, seeing animals and making pictures of nature; *playing outside* including playing hide and seek but also hunting season (a smartphone game played outside). Children also mention ghost tours in the forest and scavenger hunts. Some think of exploring and observing. Notable is that a majority of the children associates nature with walking the dog. Associations are also made with **people**; friends, family and in some cases the Nature Wise day teacher. Children also think of famous people or characters like Freek Vonk (i.e. famous Dutch biologist with a tv show for children) and Indiana Jones. **Settings** that they relate with nature are either school-related settings like the Nature Wise day, school camps and excursions or holiday and spare time related associations. Different **places** are associated with nature, mostly foreign countries, but also zoos, parks, gardens, farms, the school yard or a natural playground. Children also think of **functions of nature** such as provision of oxygen, food and energy. Some children (mainly school 3) also think of **threats for nature** such as plastic pollution, poaching and deforestation. Many children talk about **experiences** of beauty, excitement, fun, freedom, peace, nice smells and relaxation. But also of heat and boredom. Almost all children associate nature with green and outside. Many children also think of **unpleasant creatures** in nature such as the oak processionary caterpillar, ticks, mosquitos and insects in general.

All schools were given the same score for nature associations in the final nature connectedness scores, since there is no clear distinction between schools in ‘more or less connected associations’. However, the associations do clarify the concepts of nature prevalent among (Dutch) children of the current generation.

Table 11. Children's nature associations. Numbers 1-4 indicate on which schools certain associations were mentioned. Most mentioned aspects are listed first.

Outdoor sports	Outdoor activities	People	Settings	Functions of nature	Threats for nature	Experiences	Unpleasant creatures	Other
Hiking (1-4)	Walking (1-4)	Family (1-4)	Spare time (1-4)	Oxygen (1-4)	Plastic pollution (3)	Beauty (1-4)	Oak processional caterpillar (1,2,3)	Green (1-4)
Biking (1,2,4)	Seeing animals (1-4)	Friends (1-4)	(Summer) holiday (1,3,4)	Food (2,3,4)	Poaching (3)	Fun (1-4)	Insects (1,2)	Outside (1-4)
Swimming (2, 3)	Walking the dog (1,2,3)	Freek Vonk (1,2,4)	Nature Wise day (1,2)	Energy (3)	Deforestation (3)	Excitement (1,3,4)	Ticks (2)	
Soccer (3,4)	Building huts (1,3,4)	Nature Wise day teacher (1,2)	School camp (1,3)			Nice smells (2,4)	Mosquitos (2)	
Jumping the trampoline (1,3)	Exploring (1,3,4)	Indiana Jones (3)	School excursion (3,4)			Relaxation (2,4)		
Skiing (1)	Making pictures (1,3)					Boredom (1)		
Longboarding (2)	Hide and seek (3,4)					Peace (2)		
Diving (3)	Observing (2,3)					Freedom (3)		
Hockey (3)	Ghost tour (1)							
Mountain biking (3)	Scavenger hunt (3)							
Canoeing (4)	Hunting season (3)							
	Fishing (4)							

4.3. Emotional affinity towards nature

It appeared that one element of *emotional affinity towards nature* was not quite captured in *Enjoyment of Nature*, *Sense of Oneness* or *Empathy for Creatures*. Therefore I added *Personal importance of nature* as item of emotional affinity, describing whether children feel any emotional importance of nature for themselves, or solely physical importance. Together they give a more complete view on the *Emotional affinity towards nature*. The contextual explaining factors *Playing outside* and *Time spent in nature* (4.1.3-4.1.4) closely relate to *Enjoyment of nature*. They were however considered more as an expressional factor and therefore grouped among the contextual factors.

4.3.1. *Enjoyment of nature*

In their spare time many children like to play outside (playing soccer, longboarding, jumping the trampoline), usually with friends. Also at all schools many children mention gaming or playing on phones/iPad as favourite activities to do in their spare time (most at school 4, least at school 3). Remarkably, whereas at schools 2, 3 and 4 most or all children like to spend time in nature, most children at school 1 say nature is boring. Most children that like to spend time in nature, like it because there are many things to do (playing, swimming, diving, canoeing, building huts). Some children mention more expressive reasons such as beauty, smell, peace or joy (school 2 and especially school 3). Just walking in nature seems to be too boring for most children (nature should be exciting). Reasons children do not like to be in nature are mainly because *“it is boring”*, *“there are too many insects”* or *“it is dirty”*.

As becomes clear from table 12, enjoyment of nature differs quite a lot at the different schools. This is also reflected in the nature memories the children share during visualisation exercise. Most children that love being in nature also have very positive memories about nature experiences, mostly exciting experiences in foreign countries. Children that are less positive about nature, also can't think of a special nature experience they have had. Usually they come up with something nasty or funny that happened outside or with a regular activity like walking the dog or biking to school that they are rather indifferent about. Based on their expressions, children of school 3 seem to enjoy nature most, followed by school 2 and 4. Children of school 1 show least enjoyment of nature.

Table 12. Expressions of enjoyment of nature at the 4 schools

School	Enjoyment of Nature
1	<p>Most of the focus group children don't really like to be in nature (6/10); they say nature is boring or that there are too many insects. Two mention they only like nature to play or if something funny happens. 1 girl says she likes to be in nature to play and one boy mentions he likes to hike, to build huts or just to romp around in nature. Most children that state they don't like to be in nature refer to the Nature Wise day at school that they don't like, or they say nature is just not interesting for children. Biking or walking in nature leaves them indifferent. The one boy that really likes nature is also the only one having a very positive nature memory in the visualisation exercise; he goes to the mountains in Austria each year with his parents to hike and to ski and loves the views up there. Two girls share memories about things they liked in nature; walking the dog and a ghost tour. But they mention they mainly liked the dog and the tour, not necessarily the forest. Others mostly think of the Nature Wise day or a school camp in which they had either a 'funny' experience (<i>"the teacher stepped into poo"</i>, <i>"the teacher was pelted by mud"</i>) or rather a boring experience (<i>"It was really boring"</i>, <i>"I did not like to bike through the forest"</i>, <i>"I rather bike in a city"</i>). The 5 children that did not take part in the focus group, but only filled out the questionnaire, are slightly more positive. Two children explicitly mention they like to be in nature just to walk in free nature or to build huts. Two say they like walking the dog in nature, but they mainly enjoy being with the dog, not necessarily being in nature. One boy doesn't like to be in nature because it is dirty and there are many insects. Some parents indicate their child likes the activities they do together in nature, others say the children are usually not very enthusiastic.</p>
2	<p>Most children (8/9) in the focus group say they like to be in nature. They like nature because there are many things to do, such as playing and running around. Two girls appreciate nature because it is quiet, cosy and peaceful. Two boys appreciate nature because of what they can see and smell. Most children also like to be in nature because of social reasons. One boy doesn't like nature because of insects. In the memories shared during the visualization exercise the insects also play an important role. 3 children share negative memories about ticks and oak processionary caterpillar when walking or playing in the forest. Most children share a positive memory about the Nature Wise day at school. Some boys are rather indifferent about the nature memory (<i>"I only liked the swimming"</i>, <i>"It doesn't really matter how the surroundings look like"</i>). Most parents indicate the children also like the nature activities they do with their parents, such as hiking and gardening.</p>
3	<p>All children, both in the focus groups and in the questionnaire say they like to be in nature. They like being in nature because there are many things to do; playing, swimming, exercising and building huts. (A girl: <i>"I like being in nature, because I don't know what to do inside"</i>) Many children also appreciate nature for its beauty and because of social aspects. One girl likes the feeling of freedom she has in nature. The children share many exciting nature memories during the visualization exercise. Most children think about experiences in foreign countries such as jumping of cliffs, visiting caves, hiking in the jungle or in the mountains, diving and snorkelling and seeing spectacular animals or corals. Others think of nature close to home, such as a birthday party in the forest or think of something funny or weird that happened. Regarding the nature activities children do with their parents, most parents indicate the children usually like this. However, many parents indicate that just walking in nature is too boring. It becomes fun when they can do something they like, such as geocaching or playing a game. Also some parents indicate enjoyment of nature becomes less now the children grow older.</p>
4	<p>Most children (8/10) in the group say they like to be in nature. One boy likes to be in nature because it is excellent to play soccer. Others like being in nature because of its beauty, the nice smell, because of the animals you can see and because there are a lot of new things to discover. Two children are rather indifferent. One states; <i>"It looks better than bricks, but it is very muddy"</i>. Some children have very positive nature memories, such as canoeing in Sweden in a beautiful landscape or hiking in France along waterfalls. Others think about something closer to home, such as playing hide and seek or something weird or nasty that happened (such as finding a dead animal or a grandma breaking her neck). Most parents indicate their children (only) like being in nature if they can do something they like, such as swimming, canoeing, skiing or surfing. Most parents mention that their children don't like just walking in nature (boring), unless the surroundings are spectacular. One parent says her child doesn't like to be in nature if it costs too much effort (i.e. climbing a hill).</p>

4.3.2. Personal importance of nature

In the questionnaires I asked children if nature is important to them personally. Some children indicate nature is not important to them personally at all (school 1). However, most children mention nature is important to live; nature provides oxygen, food and all kinds of materials we make use of (all schools). Besides vital or utilitarian reasons, some children also mention more emotional or health related reasons of why nature is important to them personally; for rest, beauty, amusement or a healthy lifestyle (school 2 and especially 3). As table 13 shows, Personal importance of nature seems to be closely linked to Enjoyment of nature, since it appears that children of school 3, followed by 2 and 4 again relate most positively to this item, whereas for children of school 1 personal importance of nature seems to be least.

Table 13. Descriptions of personal importance of nature per school.

School	Personal importance of Nature
1	Most children in the group give utilitarian reasons of why nature is important to themselves (oxygen, food; “ <i>nature is important to live</i> ”). Two girls state that nature is not important to them personally at all. No children express emotional importance of nature for themselves.
2	Whereas some children mainly mention utilitarian reasons of why nature is important to them personally (for, food, oxygen, to breathe, to live), some children express personal importance for health or to learn and emotional importance for rest and beauty.
3	As the other groups, some children mention nature as personally important to breathe, to live. Two girls express emotional importance for calming down (a girl; “ <i>when I am sad or angry I go for a walk in the forest</i> ”). Another girl mentions importance for health (“ <i>without nature we get fat</i> ”). Some children mention all the things you can do outside as personally important, in order to amuse one selves. Others mention that the beauty of nature is important to them.
4	Most children mention nature is important to themselves for food and oxygen (to breathe, to live). A boy mentions nature is important to him for a healthy lifestyle. One girl expresses emotional importance of nature for beauty and because she loves animals.

4.3.3. Sense of oneness

None of the groups describes a *sense of oneness* with nature, in the sense of truly *feeling* part of nature as a bigger whole. There is some difference between the groups in whether they see humans as part of nature at all and whether they see similarities between humans and the rest of nature (table 14). However, since we cannot speak of a true *sense* of oneness, all schools were scored equally on this item.

Table 14. Degree to which children describe a sense of oneness with nature per school.

School	Sense of Oneness with Nature
1	The children do not think of humans while describing nature. They don't see themselves as part of nature. Most children state humans and nature are separated, that they are enemies. However, some children do see similarities and argue that humans are actually part of nature. One boy says; <i>"humans are apes, apes are animals and animals are nature; so technically speaking, humans are also nature"</i> . Another boy states; <i>"humans make houses from rocks, birds make houses from branches; that is basically the same"</i> . Though, none of the children in the group describes a sense of oneness in nature.
2	The group doesn't think of humans when thinking about nature. They don't see themselves as nature. On the other hand, the children argue that humans are part of nature, since we are all animals. None of the children describes a feeling of oneness in nature.
3	Some children state <i>"everything is nature; the whole world is nature"</i> (including humans). Others say <i>"all but humans is nature"</i> . Still others do think of indigenous 'savages' as nature, but not the modern western people. Most children agree that in the past humans and nature formed one whole, but nowadays humans and nature are separated. They don't see themselves as part of nature, nor do they describe any sense of oneness with nature.
4	The first group almost immediately mentions humans as part of nature; they see little difference between humans and other animals. <i>"Other animals also use a language. However, we are smarter."</i> The only real difference they see is that we abuse the rest of nature. The other group laughs when asked if humans are part of nature. They say <i>"humans are too lazy to be nature"</i> . However, they agree that in the past humans were part of nature. None of the children really <i>feel</i> part of nature, they do not describe senses of oneness in nature.

4.3.4. Empathy for creatures

Empathy for creatures hasn't been very directly addressed in the focus group interviews. Still, indirectly children talk about their empathy towards other creatures in nature. Many children say they don't like insects, some even state insects aren't part of nature for that reason. Some don't really care about trampling plants when playing outside and some see prey being attacked by predators as exciting. However, also some children express compassion for other creatures in nature. One girl talks to animals as if they are her friends and some girls do assign emotional values to trees or animals. Still, many children see it as a human right to use plants and animals for their own benefits.

At school 2 children express least empathy for creatures. At school 1 and especially 4 this is slightly more. Children of school 3 show most empathy for creatures (table 15).

Table 15. Degree to which children feel empathy for creatures in nature per school.

School	Empathy for creatures in nature
1	The children in the groups don't talk much about emotional affection to creatures in nature. Three children mention they like being with their dog. Many children mention they don't like insects (A girl: <i>"I hate insects, especially oak processionary caterpillar"</i>). One girl expresses emotional care for trees and projects emotional awareness on trees (<i>"I don't think trees like being surrounded by stones"</i>). The boys in the group say they think humans have the right to act at the expense of plants and animals, since <i>"we are the smartest creatures on earth"</i> . The girls don't agree, they say it is unfair that humans cut down trees, they feel regret for nature.
2	Most children express their hate of insects, especially mosquitos, ticks and oak processionary caterpillar (a girl: <i>"Mosquitos aren't nature, I hate mosquitos"</i>). They agree on that it is fair to use nature for human befits, as long as we use it for good things.
3	One girl projects human characteristics on trees and feels sorry for them; she explains how trees communicate with each other, for defence (<i>"they warn each other"</i>) but also just to talk (<i>"if humans cut down trees, they don't have anybody to talk to anymore, that is very sad"</i>). One parent says her daughter often talks to animals as if they are her friends. A boy confesses he doesn't really feel sorry for the plants when he kills them while playing soccer.
4	One girl explains she eats vegetarian because it is sad if animals are killed for human food. Another girl says she loves animals. But at the same time she enjoys seeing how a cat attacks a bird.

4.4. Environmental attitude

While analysing the focus group discussions it appeared that *environmental attitude* is not only explained by a *sense of responsibility for nature*, but that it starts with a *sense of importance of nature*. Therefore I separated those two aspects in the result section.

4.4.1. Sense of importance of nature

When asked about the importance of nature, all children immediately state nature is very important. When asked why, all children first of all explain that nature is important for us humans to live. Some mention nature is not only important because it provides us with oxygen, food, energy and other essentials, but also because it brings us happiness in the form of beauty, rest and joy. Some children state nature is even more important for the next generation. Only when asked further, children come up with broader reasons of why nature is important, not only for us, but also for itself.

It differs per school to what extent children see nature as important for more than only our own needs (table 16). Especially at school 4 children give a broad list of both instrumental and intrinsic reasons of why nature is important. Moreover, they see nature as even more important for the next generation than for themselves. Also at school 3 and to somewhat lesser extent at school 2, children see both intrinsic and instrumental values as importance of nature. One girl even sees trees as more important than humans (school 3). And although children at school 1 also see nature as very important, they mainly give instrumental reasons.

Table 16. Sense of importance of nature children describe in each school.

School	Sense of Importance of Nature
1	All children immediately state nature is important. When asked why, all children say nature is most important as oxygen supply (<i>"We cannot live without trees"</i> , <i>"Without plants we die"</i>). They also mention water infiltration. When asked if nature is only important for us, they agree that nature is also important for animals, plants and the earth itself. They argue that nature is food for animals, plants cannot grow without other plants, water and air and that the earth wouldn't exist without nature.
2	All children think nature is very important. The first thing they mention is that without plants we would die. Nature gives us oxygen and food to live and we can use it to walk. When asked, they agree nature is also important for plants and (other) animals. <i>"Nature is habitat for animals and plants need sun, water and each other to grow."</i> One girl explains how plants help each other to protect themselves. A boy; <i>"Maybe the earth wouldn't be here if there was no nature. It would be like Mars here. Everything would be extinct."</i>
3	All children agree nature is very important. Mainly for us, to live. Nature provides oxygen, food, energy and clean air. Some see it broader: A girl; <i>"everything is made out of something from nature"</i> . A boy; <i>"whole life is nature"</i> . When asked, they also say nature is important for animals and itself. One girl states that trees are actually more important than humans and that they should have more rights than humans (<i>"trees give us life, so they are more important than we are"</i>).
4	All children immediately say nature is very important. First of all for us to live, for oxygen, clean air and food supply. But soon they state; <i>"Nature is even more important for the next generation than for us"</i> . Also they see nature as important for animals and for the earth itself. They also give more emotional reasons for importance of nature; <i>"Without nature the world would look very sad"</i> <i>"Nature is important for our happiness"</i> .

4.4.2. Sense of Responsibility for Nature

Although all children state nature is very important, they don't really know to act upon this knowledge or environmental responsibility doesn't occupy their minds. They see threats to the environment and see how resulting disasters are caused by humans. However, most of them do not think about what they can do about it themselves or don't know where to start. Some say it isn't their responsibility when others pollute the environment. When asked if they do something to help nature themselves, most stick with watering the plants and a collective clean-up day at school. Many children agree that people are just too lazy to take care of nature. Though, most of them think humanity should do more to protect nature. Differences between schools were too marginal to rank them differently for the nature connectedness scores (table 17).

Table 17. Sense of responsibility children feel towards nature

School	Sense of Responsibility for Nature
1	Children do think protection of nature is important. One girl states that there are too many people on the planet. Others agree and a boy mentions the speed of climate change caused by humans (<i>"In a few years it is likely even worse"</i>). However, although they worry about the environment, they don't really know what to do about it personally or do not really think about it. Some children say they water the plants or plant new ones to help nature. Some have an insect hotel in the garden. They also mention fruit trees in the garden. With school they took part in a national garbage clean-up day. One girl says however she doesn't think it is fair they have to pick up others' trash. Though, they do think it is important to pick up trash, because it can poison nature. <i>"Fish for example eat it and in the end we eat the fish and become sick ourselves."</i> Some of the children state that it is fair how humans use nature for their own benefits, <i>"because we are the smartest"</i> . Others don't agree and mention that humans cause a lot of deforestation. One girl states: <i>"nature does so much for us and we do nothing for nature"</i> . One boy actively makes an effort to take care about nature; he collects money for the World Wide Fund for Nature (WWF) in his spare time.
2	The children do feel some responsibility to take care of the environment. One boy states; <i>"we have to, otherwise it is over in a few years"</i> . They tell about watering the plants and a collective garbage clean-up at school as activities to help nature. They do think it is important to pick up trash, because it lasts long in nature and it can poison animals. However, they admit that they only do it at such a day, when they 'have to do it'. Also a girl says it doesn't really make a difference, because people will keep on polluting the environment anyways. Acting responsible isn't something that occupies them a lot. A girl mentions: <i>"the reason I take short showers is not the climate, but because I have better things to do than showering"</i> and a boy <i>"I don't feel guilty about taking long showers, it is just really nice"</i> . In general they think people are too lazy to take responsibility for nature, but they see there is a need to do more for nature.
3	The children do see there is a need to take care of nature. They think however that most people are too lazy to actually do so and that they only want money. The children made themselves a vegetable garden at school and they water the plants at home. They also participate in a clean-up day at school. Some mention separation of garbage at home. One girl says; <i>"we plant flowers in the garden because these attract bees"</i> . However, there is a feeling of impotence; a girl mentions <i>"we are destroying nature, but still I don't know what I can do about it"</i> .
4	When asked about their own responsibility to do something for nature, most children say they separate trash and they also participate in clean-up days at school. One girl eats vegetarian because she cannot live with the idea of eating animals and also because of the environment; <i>"animals cause a lot of CO₂ emission"</i> . Although others don't eat vegetarian, they see a vegetarian diet as a way to help the environment (<i>"but I am addicted to meat"</i>).

4.5. Nature connectedness scores

All together the above described subjects form a basis to draw conclusions about children's connectedness to nature. To be able to say something about nature connectedness on the different schools I made a 'ranking' (1-4) of the schools per item of nature connectedness (see paragraph 3.4.3 for an explanation of the procedure). In this way I compared the schools on each item and concluded with a ranking of nature connectedness (table 18). For *Definition of nature* and *Sense of oneness* and *Sense of Responsibility*, no clear differentiation could be made, therefore all schools have the same score for these items. Based on these scores one could say schools 3 and 4 score highest on nature

connectedness, whereas school 1 and 2 score lowest. This is remarkable, since school 1 and 2 are the Nature Wise schools.

Table 18. Comparison of schools on different aspects of nature connectedness and a relative nature connectedness score. Scores based on a relative ranking (1-4) on separate aspects of nature connectedness. 1 indicates least inclusive description/enjoyment/time/importance/empathy/sense of oneness (4 means highest). Score is the sum of separate scores divided by the number of items (9). A higher score means higher connectedness. For a full legend see appendix 5.

School	Definition of nature	Human-nature relationship	Nature associations	Enjoyment of nature	Personal importance of nature	Sense of oneness	Empathy for creatures	Sense of importance of nature	Sense of responsibility for nature	Nature connectedness score
1	2,5	2	2,5	1	1	1	2	1	2,5	1,6
2	2,5	1	2,5	3	3	1	1	2	2,5	2,0
3	2,5	3	2,5	4	4	1	4	3	2,5	3,0
4	2,5	4	2,5	2	2	1	3	4	2,5	2,6

4.6. Explaining factors scores

Several factors can explain the degree to which children seem to be connected to nature (4.5). Nature education at school is just one of these factors. However, some others seem even more important. Cultural differences could not be measured, since all participants were from Dutch nationality (except for two with half Dutch nationality). Although socio-economic status can have an influence, data was too limited to say something about this. I did ask parents for their degree of education and their current job; education levels seemed to be slightly higher in schools 2 and 4, but the data was too limited to draw firm conclusions about this. Jobs were too variable to draw conclusions from. However, from the focus groups, interviews and the questionnaires I derived useful information on nature education, nature accessibility, time spent in nature, playing outside, parents' sense of importance of nature for children, parents' sense of responsibility for nature and role models.

As for the items of nature connectedness, I made a ranking of the influential factors, potentially strengthening nature connectedness (table 19). A higher score means more (positive) influence on nature connectedness in the form of nature accessibility, playing outside, time spent outside, parents' sense of importance of nature for children, parents' responsibility for nature and stimulation of role models. Nature education was not taken into account here, since this is the main effect I am interested

in and I want to see how the other factors might affect nature connectedness. As can be seen in the table, school 3 scores highest on all explaining factors, meaning that these children have best access to nature, most stimulating influence from parents about importance of and responsibility for nature and that they are most inspired by role models compared to the other schools. Also they spend most time outside, both playing outside and doing other activities. School 1 scores lowest on these explaining factors, meaning they have least favourable conditions for evolving nature connectedness. This is consistent with the nature connectedness scores. However, for school 2 and 4 the scores are flipped around in this case; whereas school 4 scores higher on nature connectedness, the score for explaining factors is lower. This can be explained by several factors further explained in paragraph 4.7.

Table 19. Explaining factors contributing to nature connectedness. Scores (1-4) rank the schools on each item. Higher scores mean more positive influence on nature connectedness. Score is the sum of separate scores divided by the number of items (6). For a full legend see appendix 6.

School	Explaining factors						Explanation score
	Nature accessibility	Playing outside	Time spent in nature	Parents' sense of importance	Parents' sense of responsibility	Role models	
1	2	3	1	1	1	2	1,7
2	3	1,5	3	2	2	3	2,6
3	4	4	4	4	4	4	4
4	1	1,5	2	3	3	1	1,8

4.7. Explaining results

Most remarkable in the results of my study is that the non-Nature Wise schools (school 3 and 4) score higher on nature connectedness than the two schools that do participate in the Nature Wise program (school 1 and 2) (table 18), whereas I predicted the opposite. Linking nature connectedness scores to scores of explaining factors already explains a great deal of the found results. Several other factors discussed below, can explain my findings further.

4.7.1. Explaining the extremes

First of all, when we take a closer look at the nature connectedness scores and the scores of the contextual explaining factors (tables 18, 19, 20), we can already see some clear factors explaining the nature connectedness scores distinguishing school 3 (highest score) and school 1 (lowest score). School 3, scoring highest on nature connectedness, also scores highest on all contextual explaining factors. This means that these children have most access to nature in their surroundings, they spend

most time outside (both on their own and with their parents), they like to play outside in their own spare time, their parents are concerned about nature and involved in issues around human impact on nature and talk about this with their children and they are most inspired by role models teaching them about nature. All these factors add to the childhood nature experiences that form the basis for nature connectedness. Note that conditions for school 3 might now sound perfect; they are not. It is just a relative advantage compared to the other schools.

Table 20. Overview of nature connectedness scores (NCS) and explaining factor scores (EFS) (derived from tables 18, 19)

School	Nature connectedness score	Explaining factors score
1	1,6	1,7
2	2,0	2,6
3	3,0	4
4	2,6	1,8

External conditions are the opposite for school 1. Although many children at the school like to play outside, the main difference is that the parents have far less interest in nature, don't take their children often out into nature, are also less concerned about human impact on nature and nature topics are far less frequently discussed at home. Also, the children spend very little time in nature and in general they don't have inspiring role models, telling or showing them wonders of the natural environment. Also, nature is only moderately accessible to the children; the forest is too far for playing in the own spare time.

4.7.2. Explaining the more subtle differences

Whereas for schools 1 and 3, the results can be more or less directly be explained by the external influencing factors, for schools 2 and 4 more explanation is needed. Most of the factors explaining the more subtle differences also play a role in the more extreme difference between school 1 and 3.

4.7.2.1. Influence of parents

For schools 2 and 4 there is less consistent pattern; whereas school 4 scores higher on nature connectedness, school 2 scores higher on the explaining factors. This might be explained by some of the contextual factors playing a more important role than others, whereas in calculating the scores, they were all equally valued. As a major difference between school 2 and 4, we see that school 4 scores higher on parents' sense of importance and responsibility, whereas school 2 scores higher on nature accessibility, time spent in nature and role models (table 19). Parents at school 4 seem to be more concerned about issues around human impact on nature. They discuss these topics more with their children and involve them in measures for climate and biodiversity. This pattern was also seen as

a major difference between schools 1 and 3. A conclusion might be that the parents are of great influence on the nature connectedness scores, more than the other explaining factors.

4.7.2.2. Socio-political environment

The observation that parents of both school 3 and 4 seem to feel most importance of nature and responsibility to take care of nature, may link to some background information gathered in table 2; there is a clear difference in political voting behaviour between areas where children of school 1 and 2 grow up, versus areas where children of schools 3 and 4 grow up. Whereas the environment of schools 1 and 2 predominantly votes right to extreme right, with confessional influences, in the environment of both schools 3 and 4 votes are predominantly green, left wing (especially in Utrecht, where school 4 is located). In general those green, left-wing parties have nature and climate topics higher on the agenda. The children thus grow up in environments with different views on the importance of nature and the need of conserving natural resources. Though this may not directly influence children, it may indirectly through parents, teachers and other role models. In the end, the general socio-political environment may strongly influence children's own beliefs. These findings correspond with the lower scores of school 1 and 2 versus 3 and 4 on the sense of importance of nature among the children themselves (table 18).

4.7.2.3. Group differences children

Another effect that I have observed, is that there was quite some difference among the levels of involvement in the focus group discussions. At school 1 children were somewhat less seriously involved in the focus group interviews than at the other schools (especially in the first focus group, less in the second); they were a bit suspicious at the beginning, they were sometimes making fun of each other and tried to show off. Some seemed to exaggerate their meanings, while others quickly tended to say they had no idea or no answer (not because of shyness it seemed, more because they did not feel like thinking about it). This improved however during the session. At the other schools, children seemed to enjoy the discussions more and took it more serious. At school 4 and especially at school 3 children seemed to have a deeper understanding of the subject matter. More than at school 1 and 2 they deeply thought about the questions and came with more extended and complex answers.

4.7.2.4. Nature education

Besides the above discussed factors explaining part of the results, also the nature education programs at the schools are worth to discuss further in explaining the results. An important note is that the Nature Wise programme was experienced very different at schools 1 and 2. At school 1, almost all children did not like the programme. By further asking why, it turned out that the main reason was that they did not like the Nature Wise day teacher. The bad experiences with the teacher seem to have an adverse effect on the actual goal of the program; because the children don't like the teacher, they don't like the Nature Wise day and most children even dislike nature likely for that same reason. Although the other explaining factors also were less favourable at school 1, the bad experience of the Nature Wise programme will have contributed to lower scores on nature connectedness, mainly on emotional affinity towards nature and environmental attitudes. Children at school 2 had a way more positive

experience of the Nature Wise programme. They liked the Nature Wise days, especially because it allowed them to be outside the whole day and play a lot.

However, children of both schools mentioned that they experienced most of the Nature Wise days as very similar and they had the feeling they did not learn a lot during these days. It seemed like children did not quite understand the meaning of the programme. One boy clearly expressed the feeling most children seemed to have; *“Sitting down a tree and listening to the environment doesn’t teach me anything about nature”*. The statement shows that children do not quite understand *why* certain things are done during the Nature Wise day. This idea seemed to be fed by the school teachers themselves. Especially at school 2, the class teacher was very sceptical about the programme. For him, as for the children, learning about nature equals remembering names of plants and understanding processes of nature. The value of experiencing and discovering nature seemed not to have landed well by both the teachers and the children.

The apparent misunderstanding as well as the experience of the Nature Wise programme of the children and class teachers shows great contrast with the believes of the headmasters or location leaders of the schools, that were extremely enthusiastic about it. Especially at school 1, the headmaster of the school believed strongly in the approach and the effects of the programme. Surprisingly, she was also convinced that all children loved the programme (whereas the children themselves expressed the opposite). At both schools there seemed to be some mismatch in the goals and believes of Nature Wise and the headmasters at the one hand and the class teachers and the children on the other hand. Because of this mismatch a great deal of the goals of the programme might not be achieved, simply because the good intentions do not match the expectations of both the children and the teachers. This mismatch likely has influenced the nature connectedness scores.

Although nature experiences in education at school 3 and 4 were less, experiences seemed to be more positive. An explanation might be that everything that is a compulsory subject at school (as the Nature Wise programme basically is), is already beforehand experienced as more negative. At schools 3 and 4 the sporadic nature experiences have a less continuous character; most are excursions, that already give the children the feeling that they skip a day of normal learning at school. Therefore most children liked these days. However, they mostly liked being outside, not necessarily ‘learning’ anything (which also at these schools seems to equal doing tasks, writing things down, remembering things).

Overall, all children of all schools indicated that they would like to have more lessons outside, under the conditions that the teachers are nice and that they don’t have to ‘learn’ too much. They mostly want to play outside. Giving the children the feeling they don’t have to learn, while they are actually learning by observing and experiencing would thus likely help to give the children more positive feelings about outdoor teaching programmes, also if these are a structural part of the programme.

An important note on nature education at all schools (not only in my study but at all schools, at least in The Netherlands and probably most schools around the world), lessons in or about nature only form a minor part of the total education. And though these lessons may slightly affect children’s worldviews and aspects of nature connectedness, nature lessons as currently embedded in a settled worldview (being only a drop in the ocean), cannot be expected to have a stunning influence on its own.

4.7.3. Nature connectedness

Having discussed the major and minor differences found between schools, let us now take a closer look at how the differences are distributed per pillar of nature connectedness. Table 21 summarizes the scores per each of these pillars. School 3 and 4 consistently score highest on each of the pillars. However, among the components of nature connectedness making up these pillars, there is more variation (table 18). Looking at the scores on both the component and the pillar level and connecting these the explaining factors, gives insight in the major factors influencing nature connectedness.

Table 21. Summarized nature connectedness scores on the level of the three pillars Conceptualization of nature, Emotional Affinity towards Nature and Environmental attitude. Numbers indicate mean ranking scores per pillar as provided in table 18.

School	Conceptualization of Nature	Emotional affinity towards nature	Environmental attitude
1	2,3	1,9	1,8
2	2,0	2,6	2,3
3	2,7	3,6	2,8
4	3,0	2,6	3,3

4.7.3.1. Conceptualization of Nature

For the components of nature conceptualization, schools scored largely similar. Though subtle differences may be observed, in general children's definitions of nature and associations with nature came down to a similar, rather anthropocentric image. Overall, all schools make a clear distinction between humans and the rest of nature and place humans as a species above other species in nature. Many argue that we evolved as the smartest creatures and therefore obtained to a certain extent the right to use nature and its resources for our own benefits. This similar general image of nature is very likely the result of the identical Western culture of which we are all part. Moreover, all children came from Dutch or at least half Dutch families, mostly without any other cultural influences.

There seems to be gap between *defined* and *experienced* nature, reflected in how children define what nature actually *is*. In general, children defined nature as all that was not made by humans (the sky, the oceans, ancient forests etc.), stressing the view that humans and nature are separated entities. However, when talking about nature or describing experiences in nature, often parks, gardens and school yards were described as natural settings.

Not surprisingly, children mainly describe types of nature they have seen or that they know about. Most definitions of nature comprise trees, green and forest, since this is what children experience as nature in their direct surroundings. More diverse nature surrounding homes, holidays and nature films seem to add to more diverse conceptualizations of nature and may therefore be important in forming nature conceptualizations.

There is, however, some difference in how children see the human-nature relationship at a somewhat more specific scale. Though all children agree humans cannot (ab)use nature limitlessly, children at schools 1 and 2 express a more utilitarian and dominant relationship of humans and nature, whereas schools 3 and 4 show somewhat more humility towards nature. The higher scores of schools 3 and 4 seem to link directly to their higher scores on *parents' sense of importance of and responsibility for nature* and matches their own higher scores on *sense of importance of nature*. In both concepts (nature conceptualization and sense of importance), the image of the human-nature relationship plays an important role. Likely, parents have an important influence on this image.

4.7.3.2. *Emotional affinity towards nature*

Regarding *emotional affinity towards nature*, there seems to be an important influence of *nature accessibility*. School 2 and especially school 3 are situated in more natural surroundings. This links to the relatively high scores of these children on *time spent in nature*, resulting in more *enjoyment of nature* and more *personal importance of nature*. However, in the end school 2 and 4 have the same score for emotional affinity towards nature (table 21), because children in school 4 score higher on *empathy towards creatures*. This may have to do with the more ethical aspect that is involved in this item, a moral aspect that may be influenced rather by parents or other role models than by own experiences in nature. However, it can also be connected to the fact that a factor as empathy may easily be subject to romanticizing nature, misleadingly resulting in more 'empathy', but only on a superficial level. For sense of oneness, no clear distinction could be made between schools.

4.7.3.3. *Environmental attitude towards nature*

Regarding *environmental attitude*, there seems to be a close link to the influence of parents and the socio-political environment in which children grow up. From the results it became clear that children at school 3 and 4 grow up in environments where nature and the environment play an important role in the daily life. Parents involve their children in these issues. This seems to be more important than other explaining factors, such as spending a lot of time in nature or having access to nature. Scores of school 4 are illustrative for this; they score rather low on most external explaining factors except for parental influences. As seen in table 2, they do grow up in the most green, left-wing socio-political environment. This may explain their high scores on environmental attitude, relative to other items of nature connectedness and relative to the other schools.

Though, as also became clear in my study, the influence of parents can highly vary between children. Some children have parents that are very involved in nature and environmental issues themselves and actively or passively involve their children in this. Many children have parents that do not care so much about nature themselves. Especially in these cases, nature education at school may play an important role. This links back to the results found in the questionnaires for parents, in which many of them state children raise environmental issues themselves at home because the topics are discussed at school.

4.7.3.4. Overall Nature connectedness

Having discussed the found differences between the schools and factors influencing the general conceptualizations of nature, emotional affinity towards nature and environmental attitude, what does this mean for the actual connection to nature among the different groups of children? As the results suggest (table 18, 20), children in school 3 and 4 are relatively more connected to nature than children in schools 1 and 2. But what in the end causes this difference? And what does it mean?

The conceptualizations of nature turned out to be rather similar over the groups, except for the fact that children in school 3 and 4 have a slightly more inclusive and eco-friendly view on the human-nature relationship than schools 1 and 2. The main difference was seen in how children see the utilitarian relationship between humans and nature; children of schools 1 and 2 attributing more rights to humans to use nature for their own benefits. Another difference is that schools 3 and 4 score higher on empathy for creatures. Though, this difference was not highly explicit. Differences are based on some individual expressions, since most children did not express anything about the topic. One more difference seems to be the view on the sense of importance of nature. Although all children agreed on the fact that nature is very important, mainly for ourselves, children in school 3 and 4 gave more emotional reasons for the importance of nature and in some exceptional cases they pointed at the intrinsic value of nature. However, overall, mainly instrumental values were mentioned.

The observed differences seem to occur mainly on a cognitive, moral level, in general less on expressive or emotional levels. Summing all aspects, schools 3 and 4 score higher, but does this indeed mean they are more connected to nature? I would be a bit precautionary to say so. It is important first to reflect further on the results, the methodology and the used theories before we can draw any conclusions about children's actual nature connectedness. These reflections follow in the next chapter.

5. Discussion

Having presented the results following from the focus groups, questionnaires and interviews, the next sections are used to discuss and reflect on those findings. Some results can be explained logically, whereas others raise new questions. In the light of previous studies, some of my findings are remarkably different. Further discussing on the results, used methodology and theories, leads me to more embedded conclusions in chapter 6.

5.1. Reflection on results

5.1.1. *Children's images of nature*

In contrast to many earlier studies (e.g. Boeve de Pauw & van Petegem, 2012 and Bragg *et al.* 2013), the results of my study suggest that (Dutch) children (age 11-12) have rather anthropocentric worldviews. Most groups concluded humans stand above nature and therefore we have the right to control nature to a certain extent. They made a clear distinction between humans and nature. Many children argue that we have the right to use nature for our own benefits, "*since we have evolved as the smartest creatures on Earth*". However, most children also mention that we should use nature in a responsible way, "*since we have a responsibility to conserve nature and its resources for next (human) generations*". Only some children state that humans should actually be considered as equal to or less important than the rest of nature. According to these findings, the children relate most to the image of humans as *stewards of nature* (table 1). This image describes that humans stand above nature, but do not own nature. We can use and adjust nature, but there is a responsibility to conserve nature for future generations (Zweers, 1995). This image of humans as stewards of nature was quite consistent over both the schools with and without the Nature Wise program. This might indicate that this image applies to a major group of children at this age in The Netherlands and that nature education in primary schools, to the extent it is currently implemented, does not affect this major image of the human-nature relationship. This is an interesting note, since previous studies, such as Boeve de Pauw & van Petegem, (2012) and Bragg *et al.* (2013) concluded that children of similar age, especially in Western countries tend to relate more to the image of humans and nature as partners. Several factors may account for these findings.

My findings, that point towards anthropocentric worldviews among children, are not very surprising if we take into account the Western culture in which these children grow up. For over 2000 years the idea that humans are dominant over the rest of nature has been central in the Western worldview. Evolving from the ancient Greek and Roman philosophy and then incorporated in Christian teaching, this idea of supremacy has become a major aspect of the Western attitude towards nature. Only in the last decades we have started to reflect critically on this image and have started to consider alternative views (Schouten, 2013). And although many people cognitively agree with more ecocentric images, changing the default image might simply take more time for actual internalization of these views. It would be naïve to think it is possible to change a worldview, settled in our culture for over 2000 years, in just a couple of years. The fact that the human-centred image has such a strong foundation in our culture, may also account for the apparent 'schizophrenia' observed when it comes to nature images; although people cognitively and normatively seem to relate to more ecocentric worldviews, effectively we stick to the old human-centred view (Schouten, 2013).

This mismatch between what I would call desirable, normatively, ecocentric images of nature that are expressed and our actual default way of seeing and approaching nature may also explain the fact that my results differ from previous studies that sketched a more romantic view of children's nature images (e.g. Boeve de Pauw & van Petegem, 2012; Bragg *et al.*, 2013). In my study, I noticed that normatively many children relate to more ecocentric views, in which they largely copy images of their parents. However, the default image expressed in their descriptions of nature, the associations with nature and the way they implicitly talk about nature, shows a more anthropocentric image. It shows the same 'schizophrenia'; what is experienced as nature, is often not cognitively defined as nature.

It is important to realize that, although children at this age are largely influenced by their parents, they may show a more realistic, less 'desirable' image of nature than adults because they might think less about what 'should be answered'. Consequently, children's images of nature may be an important source of information for a societies' actual image of nature. In the end, our children are a 'product' of our societies, who's images reflect the general views prevalent among us. Stating that our images of nature have changed towards more ecocentric views, as was for example done by van den Born (2006), might therefore be a premature conclusion. My conclusion would rather be that there is a change in normative awareness, but that we still stick to traditional Western images of nature as our default frame.

It would be interesting to see whether there is a difference in nature images among younger versus older children. According to the biophilia hypothesis (Kellert & Wilson, 1993) and theories of ecopsychology (Phenice & Griffore, 2003) children are born with an ecocentric worldview and have an innate desire to relate to the natural world. External influences from our human-centred societies are argued to reform these ecocentric views into more anthropocentric images of nature. Children around the age of 12 already received quite some external influences, shaping their worldviews. If these theories of ecopsychology hold true, I would probably have found more ecocentric views among younger children at the same schools.

5.1.2. *Children's nature connectedness*

In line with previous studies (e.g. Louv, 2008; Cheng & Monroe, 2012; Adams & Savahl, 2015; Collado *et al.*, 2016; Postma, 2016), I found that positive experiences in nature are crucial for building nature connectedness. Not surprisingly, *nature accessibility* showed to be an important condition for these experiences to take place. My study showed that nature accessibility mainly influences *emotional affinity towards nature*. The results in my study show that children who have more access to nature, consequently spend more time in it and as a result enjoy nature more and assign more personal value to it. This observation links back to the *attachment theory* discussed earlier; stating that early positive experiences in nature foster a sense of relationship to the natural world (Clayton *et al.*, 2012; Jordan, 2009; Louv, 2008). However, although children in my study showed more emotional affinity towards nature as a result of nature experiences (in terms of enjoyment and personal value), they did not express any internalization of subjects in nature, as is argued by Jordan (2009) to be part of this attachment. I could also not grasp upon a *sense of oneness* with nature described among the children in my study. Such a feeling seemed too far from the daily reality in which the children grow up and does not match the image of nature they relate to. The forming of an *ecological self*, described by Naess & Drengson (2008) and Jordan (2009) as relating oneself to other beings in nature, internalizing subjects in nature and developing a sense of attachment, seems still a rather abstract theory when reflected upon the expressions among children in my study.

Regarding *environmental attitudes*, my study showed that children are in general highly aware of environmental problems, human impact and the importance of nature, thereby confirming findings of e.g. Bonnet & Williams (1998) Evans *et al.* (2007) and Collado *et al.* (2016). However, I found that the *sense of importance of nature* is often not expressed in a *sense of responsibility for nature*, an observation also found by Schouten – van der Laan (2017). It seems that an actual, individual sense of responsibility for nature is a step too far for children at this age and probably not within their circle of influence. Furthermore, I found that environmental attitudes are mainly influenced by parents and the socio-political and cultural context in which children grow up, rather than by own experiences in nature. The importance of parents on environmental attitudes was stressed before in studies of e.g. Kals *et al.* (1999), Chawla (2006), Cheng & Monroe (2012) and Schouten – van der Laan (2017). However, in contrast to Li & Lang (2014), who concluded children (in China) have more pro-environmental attitudes than their parents, I found that children's environmental attitudes actually highly reflect those of their parents and the environment in which they grow up.

Overall, the results of my study point towards a more conservative conclusion on children's connection to nature than previous studies have suggested. For example Bragg *et al.* (2013) concluded that children (age 8-12) in general score high on nature connectedness using a variety of scales and measures. This difference mainly arises from the way nature connectedness is approached in my study versus other studies. Although my conceptual model and methodologies were largely based on previous studies such as Cheng & Monroe (2012), Manoli *et al.*, (2007) and Kals (1999), I evaluated the concept in a different manner, focusing more on expressions rather than cognitions. I observed a gap between cognitive and normative reasoning about nature versus basic views and expressions. On the one hand, children's cognitive and normative reasoning strongly relates to the New Environmental Paradigm (Dunlap & van Liere, 1978), strongly relating to nature connectedness as used in current literature. However, I found that this pattern is mostly influenced by the social environment in which children grow up and rather reflects moral, 'desirable' considerations rather than actual views, feelings or expressions. This became clear through the more emotional aspects of nature connectedness that children showed little relation to. In paragraph 5.3 I discuss further why these emotional aspects might say more about actual nature connectedness than the more cognitive and moral aspects do.

5.1.3. *Effects of nature education programmes*

An important aim of this study was to evaluate whether experience-based nature education programmes, such as the Nature Wise programme, contribute to a sense of nature connectedness among children. Based on my results I could not prove such an effect. However, concluding there *is* no effect, would be inappropriate. Earlier studies into the same Nature Wise programme, but in an earlier phase, did indicate positive effects of the programme such as increased knowledge of nature, enjoyment of nature and, positive attitude and a sense of responsibility towards nature (Kieviet & van Koppen, 2008; van der Waal *et al.*, 2012). Though knowledge of nature was not a focus in my study and thus cannot be compared, the other aspects were and resulted in different findings. Results for enjoyment of nature were not clear-cut among the schools I evaluated. However, this is likely due to a negative atmosphere around the programme at 1 school, as explained in 4.7.2.4. More interesting is the contrasting finding of attitudes and responsibility towards nature I found among the Nature Wise schools in my study compared to the previous studies. First of all, though Kieviet & van Koppen (2008), conclude positively about the programme, they are very cautious in drawing any conclusions going further than that 'most children like the programme' and mainly teachers mention further positive effects. They didn't find any proof for increased nature connectedness due to the programme.

Van der Waal *et al.* (2012) did a more extensive study, stretching over multiple years. As in my study, they compare Nature Wise schools to schools with 'regular' nature education. The main difference is that their study included more schools and that they observed students for multiple years. This allowed them to make comparisons both within and between groups over time. As they show in their study, the children participating in the Nature Wise programme show more affective engagement and sensible behaviour towards nature over time. However, they also acknowledge that positive effects highly depend on the further influencing factors, such as stimulating teachers (both class teachers and Nature Wise teachers), involvement of parents and the social environment in which children grow up. As in my study, the researchers acknowledged the high variety in background factors influencing aspects of nature connectedness among children. The exact implementation of both Nature Wise and other nature education programmes highly varies between schools, as well as interest in nature among teachers, parents and other role models. Moreover, in some control schools they observed similar developments of interest in nature and environmental behaviour as in Nature Wise schools. In line with my own study, both studies show it is hard to draw any firm conclusions about such programmes in real life settings, since background variation remains a very important influencing factor. Especially the comparison between schools with and without particular (nature) education programmes is very hard due to these varying background factors.

More studies have investigated the effects of nature education programmes on (aspects of) nature connectedness and many found positive results. Manoli *et al.* (2014) showed an increase in environmental awareness and behaviour among (Cypriot) children participating in a programme focused on nature and sustainability implemented at primary schools by testing the same children before and after the programme. Unfortunately, I didn't have the opportunity to take such an approach to study the development of aspects of nature connectedness among the same group of children over time, due to the limited time frame of my study. Turtle *et al.* (2015) also found positive results concerning environmental attitudes among children participating in a Forest School programme in the UK. As in my study they compared children participating in Forest School programmes to children who do not follow such a programme and found that Forest School children show more pro-environmental attitudes. However, they also acknowledge that there are many other factors that might influence these results. Regarding worldviews, including views on the human-nature relationship, Li & Lang (2015) found that education in 'green schools' in China can significantly contribute to more environmentally friendly worldviews, but that these views are highly influenced by the environmental view of parents and by the education level within families. Similar mixed results were found by Mullenbach *et al.* (2018) concerning the effect of a multiple-day outdoor education programme on children's nature connectedness. Though the results suggest some positive effects of the programme regarding aspects of nature connectedness, evidence is too little to conclude anything about changed connections to nature.

In line with the above mentioned studies, my study confirmed that education (whether or not with a specific nature education programme) can influence environmental awareness among children. In all schools, I noticed positive effects of environmental education on environmental awareness; parents indicated children learned about nature, climate change and environmental threats at school and that children brought up these topics at home. It shows that nature education of any kind can help in raising awareness about environmental issues, even if parents and the rest of the social environment do not contribute to this. This effect is already reached only by marginal efforts of schools to involve nature into the education programme and thus could potentially be much more important when implemented at a more substantial scale. Moreover, as is also stated by Li & Lang (2015), especially when children are raised in less favourable social environments, concerned less about environmental issues, the

school is very important in raising environmental awareness and stimulating nature connection among children.

What all studies, including mine, have in common is that they show it is very hard to grasp upon a broad concept as nature connectedness as a result of a certain nature education programme. Especially effects compared to control groups are hard to justify due to many external influencing factors. Although some studies show environmental attitudes can be changed by nature education programmes, studies didn't show any fundamental changes in nature connectedness. Apart from the fact that these effects are hard to measure, this may also have to do with the time frame of the research (maximum of a development over a couple of years) versus the time it may take to change one's views on nature and one's relation to nature. Though one's relation to nature and one's environmental attitudes may change in a couple of years or decades, one's basic worldview might slightly shift over a lifetime, but is unlikely to change fundamentally within the span of even a generation (taking into account the long history of the establishment of our current worldviews). Moreover, it may not be very surprising that no stunning effects are found in studies evaluating only one facet (a particular nature education programme in school practiced a couple of days a year) in the multifaceted development of children's relation to nature. This does not mean that influences of the school are negligible. What it does say, is that nature education still is a negligible part of most traditional education systems. To have a truly significant impact, nature should become a topic that is much more embedded in the total education programme.

5.2. Reflection on methodology

Before drawing any conclusions, let us take a closer look at the used methodologies. Some methodological details might have influenced the results in one way or another. There are also some limitations in the methodology that should be optimized in further research.

5.2.1. Questions and questioning

In general, the interviews went well and most questions were understood properly by children. However, we can question whether the questions used in this study to address aspects of nature connectedness are most optimal. Though they were based on formerly used questions in studies into nature connectedness, my experiences show that some questions were not ideal to use.

While analysing the results it became clear that especially one question was unclear to children. In order to infer definitions of nature in questionnaire B, I asked; "*What is nature according to you?*". Looking back it is quite understandable that most children answered this question with answers like "*very important*" or "*beautiful*". I should have asked maybe "*How would you describe nature?*". This question was only used in questionnaire B though, and thus only applied to 9 respondents.

Moreover I realized that for *Empathy for creatures* and *Sense of oneness*, there were no direct questions in the end. I aimed to infer these aspects from the answers and the discussions, which worked out to some extent, but did not result in a clear picture for those pillars of nature connectedness. It turned out that the feeling of oneness lies so far from the daily reality of the children, that they did not tend to mention any aspects of it. For empathy for creatures this was slightly more, but I think more direct questions might have helped to get a better picture for those items. A question

for *Sense of oneness* could for example be; '*Do you feel part of nature when you are in a forest/on a mountain etc?*'. However, such a direct question might also have some shadow sides. For children such a question might be too abstract and a direct question like this might result in a rational answer rather than actual *experienced* oneness in nature. I would advise to test different methods for obtaining useful information for these rather abstract aspects of nature connectedness. These might be questions or exercises.

Apart from this, I realized that the questions for *Sense of Responsibility* were now too much focused on individual actions rather than an actual individual *sense* of responsibility. This resulted in answers more fitting under the concept *Environmental behaviour* rather than applying to *Sense of Responsibility*. Individual questions for children concerning environmental behaviour turned out to be a bridge too far. Only a few children expressed their own sense of responsibility in actual individual actions, such as eating vegetarian or collecting money for the WWF. However, children in primary school are still highly dependent on decisions of their parents and cannot be expected to have a high degree of autonomy over their own environmental behaviour. Though, confronting them with the question, made them think about the possibility to actually do make personal decisions concerning the environment.

Also in the questionnaire for parents there was some ambiguity. First of all, whereas in the children's questionnaire we started off with defining nature, in the questionnaire for parents nature was not defined as such. This led to some confusion about the term 'nature' itself; whereas some parents interpreted nature as forests or nature reserves, many parents also interpreted nature just as 'outside'. Definitions of nature also weren't used consistently throughout the questionnaire. One and the same respondent could answer the question - *Do you spend a lot of time in nature together with your child?* – with “*we come outside, but we are only in nature during holidays*” and the question - *Does your child spend a lot of his or her own time in nature?* – with “*yes, he plays a lot out on the streets*”. Asking parents to define nature beforehand, might have avoided some of this ambiguity.

Inevitably, the questioning will have influenced the answers and in the end the results. By asking for example “*Do you learn a lot about nature in school?*” I might unintentionally have pointed towards learning as this is often embodied; cognitive learning by rehearsing facts, working from books and making exercises. The more experimental learning might not be considered as learning by the children and thus will have been skipped in answering the question. Another example is a question like *Are humans part of nature?* By asking this, implicitly I already give the idea the humans and nature might be separated entities. However, questioning like this might also be needed to match with the children's frames of reference.

5.2.2. Visualization

To stimulate the children to answer not only rationally, but also to access their feelings and emotions towards nature, I started the focus group interviews with a visualization exercise. Due to time limitations I kept the visualization exercise short. However, I think a more elaborated visualization exercise could have helped to get the children more from their default rational brain towards the more experiential. This might have helped in relating more to how nature is experienced physically and emotionally. Probably this would have resulted in more information on the normative and expressive dimensions of nature.

5.2.3. *Investigator influence*

It would be interesting to see whether investigator triangulation would have led to different results. For the current study I was the only investigator. Inevitably my own worldview and ideas have shaped the research to some extent, since I was the one designing, executing and analysing all aspects of the study. Mainly for the focus group interviews, investigator triangulation would be helpful to filter out personal influences. Also for the analysis of data, independent triangulation by different investigators would be good to prevent narrow interpretations fitting into one's own views. Even better would be to both design, execute and analyse the study with researchers from different cultural backgrounds. Although I tried to free myself to some extent from my Western image of nature, inevitably I think, work and act from this deep rooted Western perspective. An advantage is that my own background matched well with these of the children (almost all Dutch middle to upper class), potentially making conversations easier. However, a researcher working from a totally different culture, with different views on the human-nature relationship, will likely have had different conversations.

Since investigator triangulation was not possible in my study, I have tried to work with an open mind, inviting views different from my own and giving these a place. For the analysis I have asked critical feedback from others, to help me broadening my views. In this way I hope to have secured optimal objectiveness.

5.2.4. *Geographic locations*

Ideally the schools in my study would have been located in the same area. I found that the difference in geographic location of the schools has had important influence on the results. First of all nature accessibility seems to be a very important factor in establishing nature connectedness. All children of the different schools grow up in different environments; whereas children of school 4 live in a city with little nature around, children of school 2 live surrounded by mainly farm fields, those of school 1 in an average village with little nature, while children of school 3 grow up in surroundings with much more nature in different types. This causes major differences in nature accessibility. If schools would have been located for example all in Utrecht, the environment in which children grow up would have been more similar.

The geographic location not only influenced the accessibility to nature, also different geographic environments turned out to be different political environments; schools 1 and 2 being situated in more conservative, right-wing areas and schools 3 and 4 in more left-wing environments. Schools situated in the same geographic location might have reduced political influences.

However, finding schools in the same geographic are turned out to be hard. There are only a few schools participating in the Nature Wise programme and those willing to take part in the study happened to lie both in the surroundings of Breda. Finding regular schools in Breda would maybe have been more accurate for the study. However, it turned out not to be easy finding schools willing to participate in the research. At the moment, primary education in The Netherlands is highly under pressure; too little appreciation for teachers and too high work pressure, has led to a problematic shortage of teachers. This in addition to the fact that my study took place towards the end of the school year, when all teachers experience extra time pressure, made that most schools refused to take part (which is quite understandable). On the other hand, already within one and the same city and its

surroundings, major differences can occur in socio-economic status, nature accessibility and political preferences.

5.2.5. Number of participants

Of course, more participants would have resulted in better validated results. Of the many schools in the Netherlands, I tested only 4. However, including parents and teachers, 77 unique minds have contributed to the study. All the views of these individual people had to be analysed carefully. Therefore, more participants would not have been possible in my case. With more time and manpower a bigger study could have been set up, potentially resulting in more balanced conclusions. However, with more participants there is also a risk for losing individual information in the big crowd.

5.2.6. Sampling bias

For the selection of schools and participants, I highly relied upon willingness of schools and parents to give permission for the study. This may have resulted in a slight bias, since probably both the schools and the parents willing to participate or give permission for their children to do so, considered the topic as important. Especially in school 3, I saw more involvement of parents, resulting in more responses to the questionnaire for parents than in other schools. This is likely the result of one parent (being my thesis supervisor) stimulating the others to participate. In school 4 relatively less parents gave permission for their children to participate. This is likely a result of less stimulation from teachers or other parents. Both in schools 1, 2 and 3 teachers or other parents were enthusiastic and reminded (other) parents for filling out the form and questionnaire. Both for the schools and for the children it is thus important to acknowledge the sample might be slightly favoured towards more interest in nature. However, both for the schools and for the parents I expect that whether or not they gave permission to participate often had more to do with full to-do lists or stimulation from others rather than willingness or interest.

In practice, the number of parents giving permission for their children to participate is mainly reflected in the number of children filling out questionnaire B. Only in school 1 and 3 more than 10 children (able to participate in the focus group) were allowed to be involved in the study, resulting in only 9 children filling out questionnaire B, of which none from school 2 and 4 (for school 2 this was because there were only 9 children in total in the class). Interpretation of the results was therefore mainly based on the focus group interviews and responses for questionnaire A.

5.2.7. Levels of analysis

In this study, different levels of analysis were used to construct the views and conditions representing certain groups of children. All children participated both as individuals and as a group in the study. Also the 'group' consisted of two levels, namely the focus groups and the schools as higher order groups. Additionally, individual views of parents and teachers were used to form the total construct for the groups of children per school. Though these different levels of analysis might on the one hand cause some confusion, on the other hand they were needed to construct the final results per school. All individual views were used to construct the group view and sometimes they were used as examples to

illustrate a certain feeling or view that seemed to live among a major part of the group. Often individual illustrations were rather exceptions and were thus not significantly taken into account to construct the overall results of a group. The views in the different schools were the final level of analysis, constructed by both the (focus)groups and individual answers.

Another connotation on the 'groups' used in this study; the discrimination between groups was now based on the different schools. However, probably the same children could have been divided in different groups based on different criteria. The fact that the children in these groups go to the same school, makes that they receive the same nature education in school, which was important for this study. However, other variables vary a lot between the individual children and thus made it hard to discriminate on the education part only. Therefore also the other influencing factors were explicitly taken into account, such as the accessibility of nature, the influence of parents, time spent outside and role models.

5.2.8. *Relative importance of factors and relative differences between groups*

To be able to compare the schools on nature connectedness, I applied ranking and scoring. By ranking the schools from 1 to 4 on each item, I could make the differences between schools explicit. However, the current ranking and scoring was done in a rather robust way; the ranking only shows relative, no absolute differences. A problem here is that the differences between the ranks can either mean smaller or bigger differences between schools and the magnitude of the difference may differ per NC item. This makes adding them into 1 score for nature connectedness rather problematic.

Moreover, in the current ranking and scoring system, all NC items were valued equally. It is questionable whether this actually holds true. I found that some factors are of more importance to final nature connectedness than others, which may make a value differentiation necessary. Especially the influence of parents, access to nature and the socio-political and cultural background seem to play a major role. Though the scores are still useful and informative, finding a way to accentuate actual differences would optimize the practical value of nature connectedness scores. For the results in my study, the scores are a handy instrument, but taking into account the limitations of the scoring method, for the conclusions of my study I assign more value to the *meaning* of the answers given by participants than to the exact scores.

5.2.9. *Weather circumstances*

The field research took place in June. The fact that the period of the research was thus during early summer, might have influenced the results to a certain extent. Temperatures in June were this year extremely high; it was the warmest month of June since 1901 in The Netherlands (KNMI, 2019). During the weeks in which the focus group interviews took place, maximum temperatures lay around 35-36 °C (versus a normal 18-25 °C). This might explain why many children answered 'swimming' as one of their favourite activities to do in their spare time. Though, already the fact that the research took place during summer, might have influenced the way children answered the question on how they prefer to spend their spare time. A substantial part of the children mentioned they mostly play outside, although they also like gaming, Youtube, or other (online) inside activities. Another exceptional situation related to the hot temperatures, were the extreme amounts of oak processionary caterpillars in the summer of 2019. Especially in the South of the Netherlands this caused a lot of nuisance. Children

were affected while playing outside. In the results the nuisance of the caterpillar were clearly visible, often a reason for children to stay inside or for parents to be reluctant in visiting nature with their children. The oak processionary caterpillar as well as mosquitos (also a summer related species) often were reasons for children to dislike nature. I expect that I would have found slightly different results if the field work would have taken place during winter. It is likely that then more children would have thought first about inside activities rather than outside activities and likely insects would have been less of an annoying factor occupying children's minds.

5.3. Reflection on theory

The model (Figure 2) presented to investigate children's nature connectedness and the theories that it is based on, make some assumptions that might deserve some additional reflection. During the research I found that some aspects need more clarification or adaption and that the model might need an update when used in further (global) research. Moreover, having worked with the existing theories and the model evolving from these, I found reasons to question whether we are actually coming to the core of nature connectedness using these models and theories or that it should be revised all together.

5.3.1. Updating the model

During the focus group research and analysis of the results of both the focus groups, the interviews and the questionnaires, I found that a couple of more factors apply to nature connectedness than I identified before (figure 2). In the end I used therefore the updated model (figure 7) for analysis.

Adding *Nature associations*, *Personal importance of nature* and *Sense of importance of nature*, gives a better model for analysing nature connectedness among children. I found that *Nature associations* as an addition to the pillar *Nature conceptualization*, gives more insight in the frame of reference from which children think about nature. Aspects they associate with nature are part of their implicit concept of nature. Including this aspect allows for a better reconstruction of children's nature concepts. Adding *Personal importance of nature* to the pillar *Emotional affinity towards nature*, was needed to come to the actual *personal* connection to nature. More than *Enjoyment of nature*, it shows actual emotional affinity towards nature based on intrinsic motivations. To touch better upon the last pillar, *Environmental attitude*, I made a distinction between *Sense of Importance of Nature* and *Sense of Responsibility for Nature*. It turned out that a personal sense of responsibility for nature largely goes beyond children's circle of influence at this age. There seemed to be a difference in a *sense of importance*, that they all felt for nature and a *sense of responsibility for nature*, to which most children did not identify themselves personally. To grasp their environmental attitude better, I added therefore *Sense of Importance of Nature* as a concept for analysis next to *Sense of Responsibility for Nature*. Including these extra concepts for analysis results in a more practically applicable model for investigating children's connectedness to nature (figure 7).

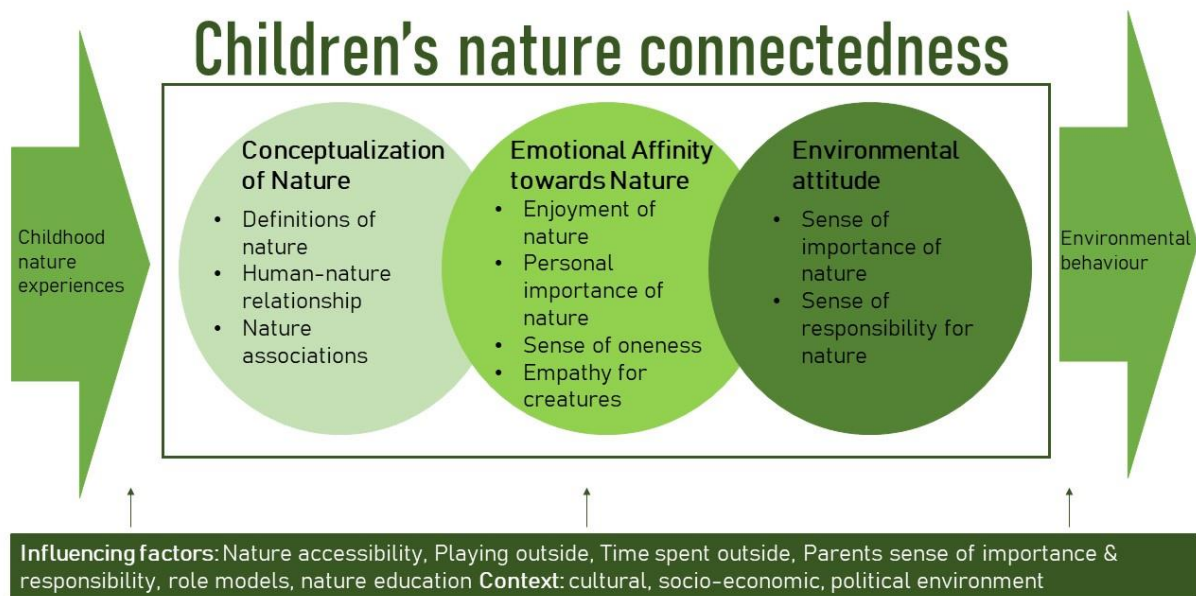


Figure 7. New model for Children's nature connectedness, based on practice and results.

Furthermore, based on my experiences, I could better identify the factors influencing the forming of nature connectedness. Nature accessibility, playing outside, time spent outside, parents' sense of importance of and responsibility for nature, (other) role models, nature education and the socio-political and cultural context (social environment) in which children grow up, all play important roles as influencing factors. However, the social environment, nature accessibility and the influence of parents, seem most important and also influence on its turn other explaining factors such as playing outside and time spent outside. I would suggest to classify them as first order and second order contextual explaining factors, whereby the first order factors shape the second order factors. And whereas nature accessibility and consequently playing outside and time spent outside mainly act on the level of physical nature experiences, thereby indirectly influencing the pillars of nature connectedness, I would argue other explaining factors may largely skip the nature experiences and act directly on conceptualization of nature, emotional affinity towards nature, environmental attitude and environmental behaviour (figure 8). Though they may be argued to be nature experiences in a broader sense of the concept; the way parents talk about nature or how nature is pictured in a culture, is in some sense also a nature experience. Afterall, it is important to realize the influencing factors act over the whole process of forming nature connectedness; from first nature experiences (in a broad sense) up to environmental behaviour.

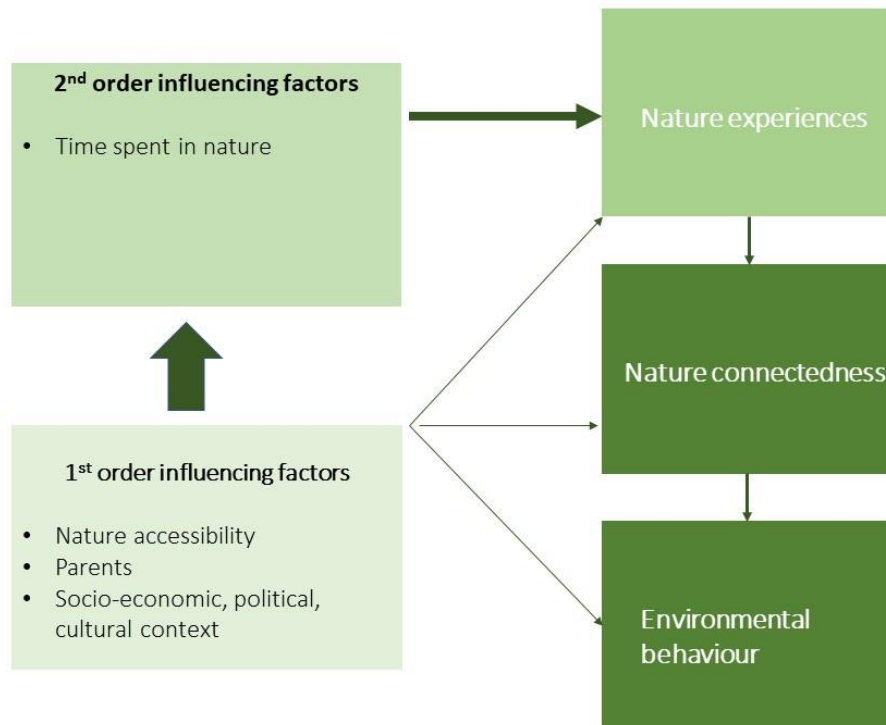


Figure 8. Relations of first and second order influencing factors to each other and to nature experiences, nature connectedness and environmental behaviour.

5.3.2. Revising the model

Although the model in figure 7 already provides a better applicable tool for investigating nature connectedness, I would argue there are still some problems with it that should be considered when using such a model in the future, especially in research in inter-cultural contexts.

A difficulty of the model is the fact that the first pillar, *conceptualization of nature*, forming the basis or context for the other pillars of nature connectedness, inevitably overlaps and interacts with the other concepts. During the study, this led to some confusion. For example the concept *human-nature relationship* appeared to be part of several concepts of the framework; it comes back in the *conceptualization of nature*, as well as in *sense of oneness* and *sense of responsibility*. This made it sometimes confusing to separate the different dimensions of the view on the human-nature relationship from each other. A suggestion to clarify the framework would be not to use the term 'human-nature relationship' as separate unit of analysis, but touch upon its different dimensions within the pillars encompassing it.

Secondly, the model was created based on quite Western theories of nature connectedness. This was useful for applying the model in a Western context. However, we may raise the question if such a model for nature connectedness does well enough reflect actual connectedness, that should in theory be independent in its meaning from cultural context. This comes back to the findings by Boeve de Pauw & van Petegem (2012) and van Petegem & Blieck (2006), who concluded that Belgian (representing Western) children relate more to the New Environmental Paradigm than children in Vietnam and Zimbabwe (representing 'developing' countries). In the used model for nature

connectedness this would mean that the Belgian children are more connected to nature, than those in Vietnam and Zimbabwe. This may be a highly misleading conclusion, taking into account that children in these so called ‘developing’ countries live in general closer to nature and are more directly dependent upon its resources. The model might miss a dimension of connectedness representing this mutual relationship between humans and the rest of nature in a direct sense. Too much focus lies on caring for the environment in terms of sustainability and conservation, which may be viewed very differently in many cultures. Moreover, in the current model the term *Emotional affinity towards nature* is mainly focused on positive emotions towards nature, whereas also negative emotions such as fear might represent a certain respect for or connection to nature.

This issue may (partly) rise from where nature is placed in our pyramid of needs, speaking in terms of Maslow (1943); whereas in our Western perception, nature and sustainability are often viewed as something on top of the pyramid, being cared for if all other (physiological and psychological) needs are satisfied, in ‘less modern’ societies, often living closer to nature, this might be the other way around; nature is seen as the basis or even throughout the whole of the pyramid, since nature directly provides the basic needs (food, water, building material) as well as spiritual needs (figure 9). The fact that nature in principle always lies at the basis, is often overlooked in Western societies, since we are not directly confronted by the fact that we highly depend upon nature for both our physical as for our mental wellbeing. Farmers and factories produce our food that we can buy in supermarkets or even online, water comes from the tap and usually we do not build our own houses (of course our basic needs also find their basis eventually in nature). Thereby, we are rarely confronted by the threats of nature, since we live in safe houses, protected by dikes, live in a friendly climate and have hardly any dangerous animals around. Nature therefore becomes something romanticized, something to love and enjoy during our spare time and on holidays, but not a part of our identity. These differences largely shape our views on nature and may result in different explanations of nature connectedness.

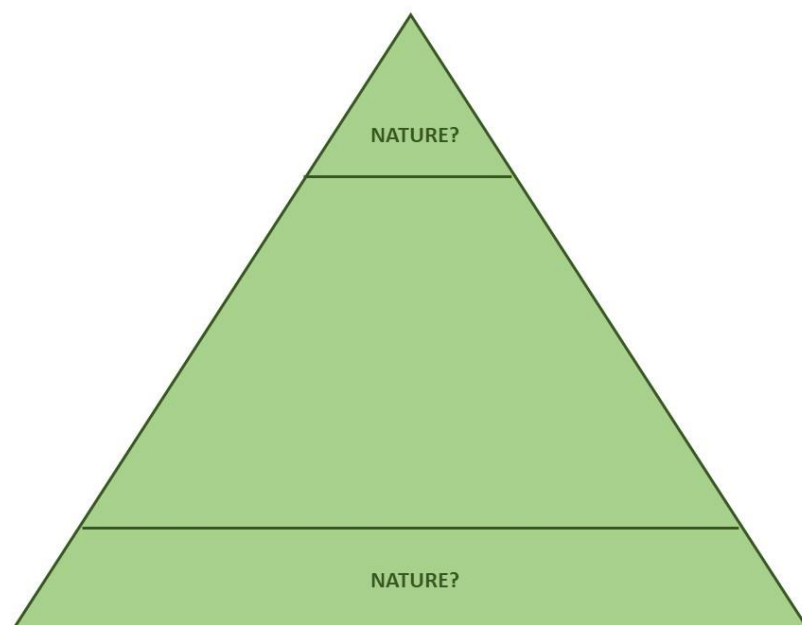


Figure 9. Where do we place nature in Maslow's pyramid of needs? Whereas in Western societies it is often placed at the top, in many other cultures it might be placed at the bottom.

Considering the above listed limitations of the current model, a new model should be created in order to reduce ambiguity and make the nature connectedness model more globally applicable. To undo the concept of nature connectedness of conflicting cultural issues, it seems helpful to focus less on cognitive or rational aspects of it and more on intuitive or emotional aspects. Incorporating *Naturalistic and Existential intelligence* into the concept or into the evaluation of it, might help to shift this focus. Naturalistic intelligence, as described by Gardner (2000) includes sensibility and awareness for and interest in the natural environment, whereas existential intelligence includes the ability to picture oneself as part of a whole, relating to other subjects in the world and being able to reflect on this. Both contribute to a certain environmental intuition and a sense of place in the whole. Just as other forms of intelligence, they can be trained and become more present. Stimulating the development of naturalistic and existential intelligence in school could thus contribute to building connection to nature and the concepts can be used to evaluate nature connectedness. Including these concepts might have benefits over inclusion of cognitive or moral aspects on sustainability.

Apart from naturalistic and existential intelligence, as additions to the model, I found that of the concepts I used, *Emotional affinity towards nature* comes closest to the actual meaning of nature connectedness. If included in the model, the items applying to emotional affinity should focus mostly on *feelings* in and towards nature. *Sense of Oneness* can be a useful concept for touching upon this. However, I found that this is a rather abstract concept among present day Western children. New studies should find a way to concretize the concept better for use among children. Similarly, *Empathy towards creatures* may be a good measure for one's relation to other-than-human-beings in nature. However, in my study it turned out to be subject to moral, cultural values that shaded actual *feelings* of empathy. Approaching the concept in a different way, more focused on own feelings than on externally influenced norms, may help to come to a deeper understanding of one's nature connectedness.

Furthermore, the concepts *Enjoyment of Nature* and *Personal importance of Nature*, used in this study, were useful measures for children's emotional affinity towards nature. However, they tend to focus mostly on positive, romanticized and useful aspects of nature. To make the model more inclusive, it may be helpful to include also more vital mutual relationships between humans and the natural environment. There should be more space for emotions such as fear and humility towards nature. Such emotions may indicate a certain respect for nature, while they are often missed while working from Western perspectives. Therefore I suggest to leave out *Enjoyment of Nature*, while adding *Humility towards nature* as a concept to capture a sense of indignation about the power of nature and the greatness of nature compared to humanity. The term is based on an expression in an essay by Arne Naess, who states; "*the smaller we feel ourselves compared with the mountain, the nearer we come to participating in its greatness*" (Naess & Drengson, 2008; p.67). He reasons that a sense of modesty is crucial in understanding our relationship with the natural world. Later he speaks about humility rather than modesty, a term expressing the meaning even better. It describes the greatness of nature over humanity whereas often humanity is seen as ruler over nature. In the end, its nature that is ruling over us.

As a suggestion I worked out a new conceptual model that may encompass the meaning of nature connectedness in a better way. Thereby including concepts that I found to touch better upon the actual core of nature connectedness. Figure 10 gives a suggestion of how that may look like.

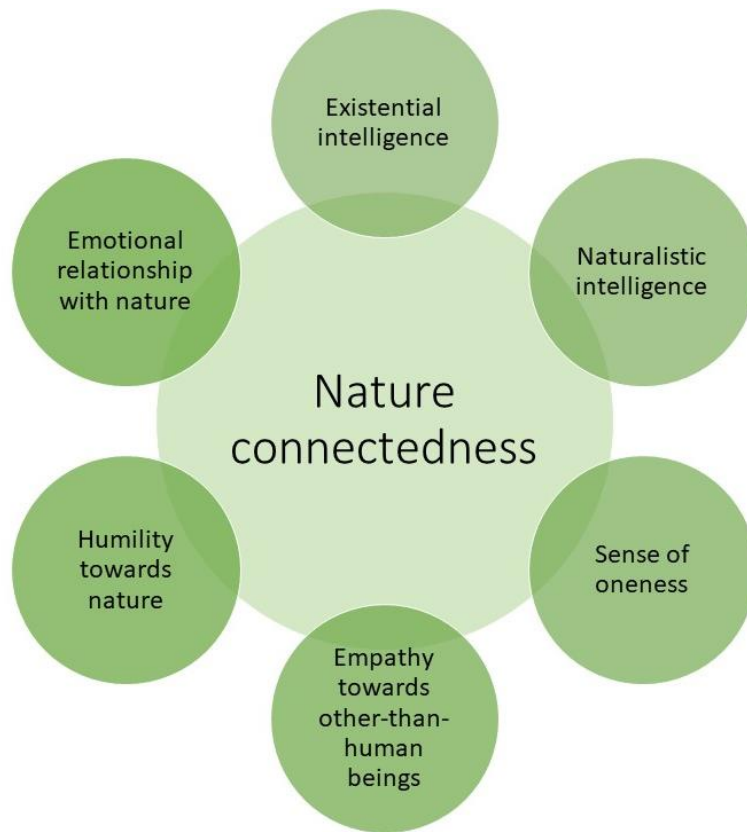


Figure 10. Proposed new model for nature connectedness, reconsidering its actual meaning. The pillars Empathy towards other-than-human beings, Humility towards nature, Personal emotional relationship to nature, Existential intelligence and Naturalistic intelligence are considered to grasp the concept in a more meaningful way than used before.

Using the above described concepts, emotional affinity itself becomes ambiguous to use as a separate concept. I also left out nature conceptualization as a concept on its own, since during the research I experienced the term interacts with many other aspects, especially concerning the position of humans in nature. Although conceptualizations of nature highly influence nature connectedness, in further research I would suggest to handle it as a separate concept to avoid ambiguity.

Leaving out more normatively shaped aspects such as *Environmental attitude*, improve the model in terms of objective, inter-cultural applicability and allow it to touch better upon the actual core of connection. In the end, *Environmental attitudes* turned out to give a rather biased view of actual nature connectedness, telling more about moral values than actual *felt* connectedness to nature. The concept, as it was used in this study as a part of nature connectedness, may then be seen rather as a result than as a part of it. However, more of an indirect result than something following linearly from nature connectedness, since still, throughout the whole evolvement of nature connectedness and environmental attitudes (if one may speak of evolvement), external factors and personal experiences have an important influence on both nature connectedness and environmental attitudes and on all of the concepts these consist of.

To go a step further, I would argue that nature connectedness is not even necessarily a precursor of *Environmental attitudes* as they are currently defined; as the results of my study and previous studies show, in many Western countries one may find rather ecocentric environmental attitudes, including high senses of importance and responsibility towards nature, without any explicit connection to nature. Though, this doesn't mean that nature connectedness is not needed in the end for truly ecocentric environmental *behaviour*. It may actually be the cause for the observed schizophrenia, the gap

between our moral beliefs about nature and our actual actions towards it. Without actual felt, emotional, connectedness to nature, ecocentric attitudes will likely not result in ecologically responsible behaviour on the long term.

Figure 11 sketches how the newly proposed concept of nature connectedness is suggested to (inter)relate with nature conceptualization, environmental attitudes and environmental behaviour. The social and physical environment encompasses the cultural, socio-economic and political setting in which children grow up, as well as the physical environment and more direct social influences such as education by parents and schools. This environment largely influences children's nature experiences, their conceptualizations of nature and their environmental attitudes. Nature experiences on its turn are the most important influencing factor for nature connectedness, which on its turn also interacts with nature conceptualization and environmental attitudes. The environmental attitudes formed by both the environment and nature experiences finally lead to environmental behaviour.

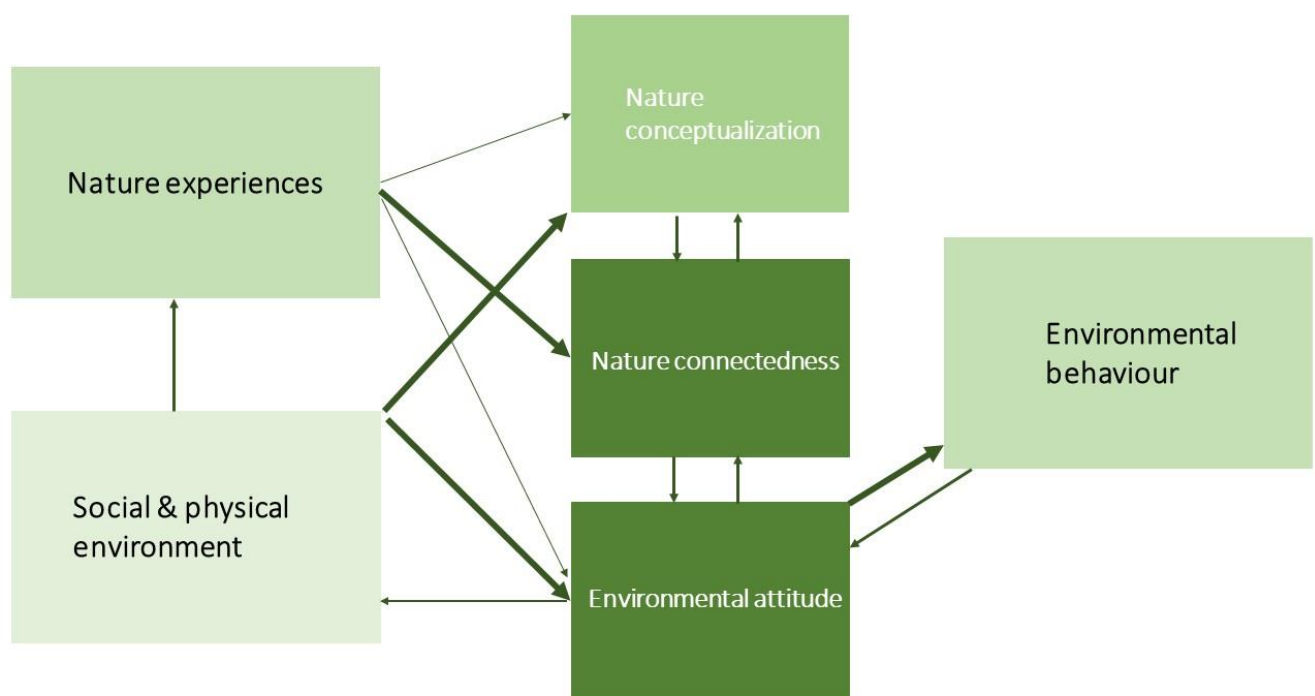


Figure 11. Inter-related pathways from social and physical environment and nature experiences through interaction between nature conceptualization, nature connectedness and environmental attitudes towards environmental behaviour (and back).

6. Conclusion

At the start of the study I posed the question; *How does experience based nature education in primary schools in The Netherlands influence children's connectedness to nature?* To answer this question, I operationalized nature connectedness as children's conceptualization of nature, their emotional affinity towards nature and their environmental attitudes. Furthermore, I questioned in what way other factors influence children's nature connectedness. The Nature Wise programme was used to represent experience-based nature education in this study.

The results show that children's conceptualizations of nature are largely similar, regardless of nature education (to the extent it is implemented today). The concept of nature that most children describe, relates to nature they know, which is mostly terrestrial nature in the form of forests. Additionally, children include landscapes they have seen on holidays or in films. For most children, nature is first of all, all that is not made by humans. However, there seems to be a gap between defined and experienced nature, since when they talk about nature, they also include human-made settings such as parks and gardens in their descriptions of nature. They relate mostly to nature for joy, for play and for living. All children report rather anthropocentric images of nature. The overall image of nature comes closest to an image of humans in a stewardship relation with nature. Children clearly separate humans of the rest of nature and most agree that humans stand above nature. However, a majority of the children agrees that humanity has a responsibility to conserve nature and its resources for future generations. This contrasts with findings of earlier studies, that found that children relate more to the partner relationship between humans and nature.

The similar general concept of nature is best explained by the similar Western culture in which the children grow up. Subtle differences were found regarding the way children see the human-nature relationship. This is mainly influenced by parents and the (rest of) the social environment in which children grow up. Children growing up in more green, left-wing socio-political environments and with parents that have an interest in nature themselves, take their children out into nature, that are concerned about the human impact on nature and talk with their children about these issues, generally have a somewhat more ecocentric image of nature. It shows that less dominant views of humans over nature in the direct social environment also result in less human-dominant images among the children themselves.

Regarding *Emotional affinity towards nature*, the second pillar of nature connectedness, not only parents and the further social environment play an important role, but mainly *nature accessibility* is a crucial factor. Children having more access to nature in their direct surroundings (home, school), consequently spend more time outside, mostly playing. As a result they enjoy nature better and assign more personal value to nature. This is strengthened by nature experiences further from home, for example during holidays. Schools can facilitate nature experiences and thereby strengthen personal relationships to nature. However, negative experiences can have adverse effects.

The important influence of the social environment in which children grow up is also seen in children's *Environmental attitudes*, in terms of *Sense of Importance of Nature* and *Sense of Responsibility for Nature*. In general children are highly aware of environmental threats and human impacts on nature and assign important value to nature. However, most do not translate this into an individual sense of responsibility towards nature. The extent to which children have pro-environmental attitudes relates strongly to social environment in which they grow up. Mainly environmental awareness seems to

relate strongly to what they see, hear and learn both at home, at school, in the media and in the further social environment.

The results do not give one clear-cut answer to how experience-based education influences the above discussed aspects of nature connectedness. In my study, the schools with experience-based nature education turned out to score lower on aspects of nature connectedness than the control schools. However, this was explained better by the important influences of the further social environment, than by effects of the nature programme itself. As in other studies, it was hard to isolate the effect of experience-based education, since it is still such a small part of the total education. The programme is embedded in a further standard school philosophy and in the general environmental discourse prevalent in the social environment. Also, the limited amount of schools involved in the study and the limited scope of this research forces me to be precautionary in drawing any conclusions about the effect of this specific nature education programme on a broad concept as nature connectedness. In the end, at all schools the external factors influencing children's views on nature and their experiences in nature were more important in explaining nature connectedness than the nature programmes themselves.

Moreover, during the study I found that the concept of nature connectedness as it is used today (both in my own and in previous studies), may lead to biased conclusions regarding nature connectedness. Throughout my study I found that the concept relies heavily on Western conceptualizations of nature and the human-nature relationship. It is to a large extent subject to moral, normative beliefs prevalent in the social environment, that do not necessarily approach one's connectedness to nature, but rather one's moral beliefs about it. This is mainly visible in the concept '*Environmental attitude*', which rather describes awareness than actual *felt* connection to nature. I would suggest to revise the use of the concept nature connectedness and focus more on the emotional aspects rising from experiences, than the normative aspects, rising from social norms. However, I acknowledge those aspects do influence each other.

All in all, it seems that actual connection to nature is mostly stimulated by own experiences in nature and is highly influenced by conceptualizations of nature and beliefs about human nature relationships in the social environment. The parents, the school and the rest of the socio-political and cultural environment, play an important role in facilitating these nature experiences and in providing nature images. Especially the school could be a place to provide alternative images of nature and facilitate nature experiences, especially for children growing up in less nature-oriented social environments and without physical nature in their direct surroundings.

More studies are needed to optimize methodologies for testing nature connectedness in which more focus lies on expressive and emotional aspects, rather than normative and cognitive aspects. Moreover, having revised the theory, long-term studies are needed to show the relations between nature experiences in childhood, nature connectedness and environmental behaviour at later age. To be able to isolate effects of school education programmes, these programmes should form a much more substantial part of the total education.

Overall, it is remarkable that children in my study seem to have a very human-centred conceptualization of nature, whereas other studies point at a shift towards more ecocentric perspectives. Though I agree that there is a shift in environmental awareness, I don't see a shift in actual basic images of nature. If this human-centred image is widespread among the current generation of children, this is worrisome, since the image we have of nature and the place we assign to ourselves in nature, forms an important basis for how we treat the natural environment. Also, once more this study shows that children spend very little time in nature, which is for a great deal due to very little

accessibility to nature. My study confirms findings in earlier studies, that more nature in children's direct surroundings, results in more time spent outside, more enjoyment of nature and a more intimate relationship with the natural environment. With the increasing loss of nature, more and more children lose contact to nature, resulting in dissociation from it. Positive nature experiences in primary education may contribute to recurve this worrisome trend. Moreover, my study shows once again the important role parents have in facilitating nature experiences and raising environmental awareness. My study indicates that parents who take their children actively out into nature, stimulate their children to explore nature by themselves and talk about nature with their children, can be a major stimulant in the development of nature connectedness. They may stimulate a sense of wonder and joy about the environment, which can have lasting effect on environmental behaviour at later age. There is thus a great responsibility of ourselves, as illustrated by Richard Louv in his book; *"The most effective way to connect our children to nature is to connect ourselves to nature."*

As a contradicting fact, especially because the influence of parents and the further social and physical environment are so important for establishment of nature connectedness, the school can play a vital role for children that do not have the luck of stimulating parents and nature around the corner. Especially in places where all external factors may negatively affect nature connectedness, positive nature experiences in school and reflections upon our own place in this whole, may spark affinity towards nature, change concepts of nature and change environmental attitudes that would otherwise not have evolved in positive directions. Together, schools, parents and governments have an important responsibility in creating an environment in which joy and wonder for nature can be sparked and children can discover their own place in nature. This would not only give children the opportunity to evolve into compassionate and healthy beings, it may also save our planet and all its human and non-human beings from environmental destruction. Children of the current generation are the next generation of political leaders in this world, in which we will still have only one planet. Let us give these children the opportunity to inherently include nature as part of themselves, developing into future leaders that consider nature as more than an object being of service to humans. For the school to be a substantial stimulating factor in this, nature should become a much more important part the total educational system. Let us start with realizing that our children and the rest of the natural environment are the most precious and the most threatened subjects in a world that we all happen to be part of.

7. Recommendations

7.1. Suggestions for further research

To build further on the results found in this study, I would first of all advise to further revise the theoretical construct of nature connectedness and how this is interrelated with nature education, the social environment and environmental behaviour at later age. New methodological approaches should be found to approach this new concept of nature connectedness in a better way. Moreover, it would be interesting to investigate the effect of age and culture on the development of nature connectedness. On the short-term studies into the effects of nature education programmes can be improved by taking into account the shortcomings of this study.

Using the knowledge on shortcomings of the current study, it would be interesting to optimize the study by repeating it on larger scale. It is important to take into account the discussion points I made in 5.2. First of all, to reduce background variation, it would be good to concentrate the schools more in one geographic area. Influences of nature accessibility, political environment and socio-economic backgrounds will then likely be less. Furthermore, to improve the results, more schools should be visited. Validating the used questions again, would further optimize the study design. To reduce investigator influence, it might be good to apply investigator triangulation by performing and analysing focus group interviews and questionnaires in teams of 2. To come to deeper emotional levels, the visualization exercise could be extended and deepened. To reduce seasonal effects, I would lastly advice to spread the focus group research over the year and filter out any season-specific answers.

Secondly, it would be interesting to take closer look on the effects of age on nature connectedness. As explained before, results or theories found in earlier studies, suggest that children have more ecocentric nature concepts at younger age. It would thus be interesting to do similar research over multiple years with children; testing whether there is an effect of increasing age on nature connectedness. Are they actually losing connection to nature through external or internal influences?

Additionally, in the current study I couldn't test for different cultural influences, since all children were born in the Netherlands and all schools were rather Dutch as well. It would be interesting to test for differences in nature connectedness among schools of different cultural backgrounds, such as Islamic or Judaic schools that are also situated in The Netherlands. Also, children in the so called Steiner or Waldorf schools (in Dutch Vrije scholen) are an interesting group to include in suchlike research, since these schools already adapted the vision of learning by experience with head, heart and hands. Nature forms an important basis for the philosophy of these schools.

In future research also new methods for testing nature connectedness could be explored. Another way to investigate nature connectedness among children might be to apply storytelling. As a first idea for this study I came up with writing stories matching different nature images and reading them to children. By questioning one could find to which storylines children feel most connection, which gives information about their basic worldviews. Though, the stories must be of very good quality and align with children's frames of reference. Multiple validation rounds would we needed to verify the method. Therefore, the method wasn't yet suitable for my study. For following studies it would be interesting to explore the option of storytelling as a tool further.

To test the actual relationship between nature experiences at young age, nature connectedness and final environmental behaviour (as presented in the theoretical model), long term studies should be set up. Ideally the same children should be investigated again at later age to see whether nature connectedness programmes do actually affect environmental behaviour. However, this is difficult due to privacy regulations.

Moreover, in further research into connectedness I would suggest to revise the theoretical basis of the concept itself, focusing less on moral, normative aspects and more on emotional and experiential aspects. Such a revision of the theory would allow for better understanding of the actual *connection* in the term *nature connectedness*, that is currently largely shadowed by concepts relating more to awareness than to actual connection. Having revised the concept as such, also methodologies should be optimized to approach the meaning of nature connectedness in a better way.

7.2. Suggestions for Nature Wise

The goals and intentions of the Nature Wise programme reflect exactly that what is needed to stimulate nature connectedness among children. There seems to be much potential for such a programme to actually result in more connectedness. However, the ideas behind it should then not only be visible in the Nature Wise lessons, but should be a much more substantial part of the whole education programme. During my study, I came across several aspects of the Nature Wise programme that might benefit some evaluation or improvement in order to match the practices better with the set goals of the programme.

First of all, at the first school I noticed that the Nature Wise day teacher played a very important role in the experience of the Nature Wise days and of nature itself. In this case, the experiences with the teacher were rather negative, which resulted in a negative image of the whole programme and seemingly also a more negative picture of nature itself. Respecting all good intentions, it is very important to evaluate and act upon this particular situation in order to improve nature experiences at this school. As a structural measure, I would advise a regular evaluation of the Nature Wise day among the children, the class teachers and individual meetings with the Nature Wise day teachers themselves. Inspiring teachers are crucial as a basis for stimulating nature connectedness.

Furthermore, I noticed that there is room for improvement in alignment of goals, expectations and experiences among different stakeholders. The intentions of the programme are grounded and ambitious, reflected in a well-designed programme based on nature experiences rather than rational knowledge only. The headmasters of the schools seem very well informed about the approaches and goals of the programme and support it fully. However, it seems that communication gets slightly stuck here, since some class teachers and especially children are less informed and convinced about the programme. Children and some class teachers expect to learn about nature in a classical way, as they are used to and therefore don't see how certain aspects of the programme learn them anything about nature. Children therefore do not understand certain aspects of the programme, that are focused on experiencing nature; they just don't see *why* certain things are done. Both teachers and children need to get used to this new way of learning. For better alignment of expectations, it is important to take the class teachers and children along in this quite new and different approach to nature education. I would advise to organise yearly training evenings for all new class teachers, to inform them well about the approaches, goals and intended outcomes of the programme. They can in their turn align with the expectations of the children and prepare them in a good way for participating in the programme.

As a last point, in both schools many children mentioned that Nature Wise days were often very similar. They said they'd like to have more variation and challenge in the programme. They mentioned for example quizzes and some exercises that are the same each time. I would advise to evaluate this further with children and either adapt or explain the content to match it better with the wishes of children. This would be good not only for variation in the programme, but also for other experiences children have with the programme. A panel of children for yearly evaluation could be settled to take the children along in the design of the programme, giving them the feeling they also contribute to the programme themselves. This will likely also result in better understanding of the intentions of the programme.

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9. Appendices

Appendix 1 Focus group interview

English version

1. Setting the stage

Introduction of myself; who am I? What can they expect the next 45 min?

Introduction round: Who are you? Where do you live? How does the surrounding of your house look like? What is your favourite place to play? (I share this info about myself as well)

Visualization/reflection: What is the most special experience you ever had in nature?

2. Focus group questions

1. *What would you describe as nature?*
 - Are humans nature as well? Why (not)?
 - Are humans different than other organisms in nature? Why?
 - Are parks and gardens also nature?
2. *Is nature important? Why?*
 - Is nature only important for humans? Or also for itself?
 - If nature is important for all lifeforms, why then can humans take so much more space than other species? Is that fair?
3. *Do you learn a lot about nature at school?*
 - Examples?
 - Is this fun? Why?
4. *Do you sometimes take action to take care of nature?*
 - Examples
 - Do you think this is important? Why?
 - Does it matter if you help a plant or animal? And what plant or animal? Or are all equal? Why?

1. Start

Introductie: Wie ben ik? Wat kom ik doen het komende uur?

Introductie ronde: Wie zijn jullie? Naam, waar woon je en hoe ziet de omgeving van je huis eruit?
Waar speel je het liefst?

Visualisatie/Reflectie: Wat is de meest bijzondere ervaring die je ooit in de natuur had?

2. Vragen focus groep

1. Wat is Natuur?

Evt. doorvragen:

- Is de mens onderdeel van de natuur? Waarom (niet)?
- Is de mens anders dan andere organismen in de natuur? Waarom?
- Zijn parken en tuinen ook natuur?

2. Is natuur belangrijk? Waarom?

Evt. doorvragen:

- Is de natuur alleen belangrijk voor mensen? Of ook voor zichzelf?
- Evt: Als alle organismen in de natuur even belangrijk zijn, waarom kan de mens dan zo veel ruimte innemen ten koste van andere soorten? Is dat (on)eerlijk?

3. Leren jullie op school veel over de natuur?

Doorvragen:

- Voorbeelden
- Is dit leuk? Waarom?

4. Doen jullie wel eens iets om de natuur te helpen?

Doorvragen:

- Wat doe je dan?
- Is dat belangrijk? Waarom?
- Maakt het uit of je een plant of een dier helpt? En wat voor plant of dier? Of zijn alle organismen in de natuur gelijk? Waarom?

Appendix 2: Personal questionnaire

Background data: name, school, gender, nationality

English version

1. Do you spend a lot of time in nature? Can you give some examples?
2. With whom are you in nature most of the time?
3. Do you enjoy being in nature? What do you enjoy about it or not?
4. Is nature important for yourself? Why?
5. Do you learn a lot about nature at home? From whom? Can you give some examples?
6. Are you often in nature with somebody who can tell a lot about it? Who? Do you enjoy this?

Extra questions for children not participating in the focus group;

1. What is nature according to you?
2. Is nature important? Why?
3. Do you learn a lot about nature at school? What? Do you like that?
4. Do you sometimes take action to take care of nature? What? Why?

Dutch version

1. Kom je veel in de natuur? En kan je daar een paar voorbeelden van geven?
2. Met wie ben je meestal in de natuur?
3. Vind je het leuk om in de natuur te zijn? Wat maakt dat je het wel of niet leuk vindt?
4. Is de natuur belangrijk voor jouzelf? Waarom?
5. Leer je thuis veel over de natuur? Van wie? En kan je daar een paar voorbeelden van geven?
6. Ben je vaak in de natuur met iemand die er veel over kan vertellen? Wie is dat? Vind je dat leuk?

Extra vragen voor kinderen die niet deelnemen aan de focusgroep

1. Wat is natuur volgens jou?
2. Is natuur belangrijk? Waarom?
3. Leer je op school veel over de natuur? Wat leer je dan en in wat voor soort lessen? Vind je dit leuk?
4. Doe je zelf wel eens iets voor de natuur/om de natuur te helpen? Wat? Waarom?

Appendix 3: School interview

English version

1. Is nature an important topic at your school?
2. What kind of nature activities do you do with children at your school?
3. Do you think the children enjoy these activities?
4. What do you think children learn from these activities?
5. Why did you choose for certain nature activities at school?

Dutch version

1. Is natuur een belangrijk onderwerp bij jullie op school?
2. Wat voor activiteiten doen jullie omtrent natuur?
3. Denk je dat de kinderen dit leuk vinden?
4. Wat leren de kinderen van deze activiteiten?
5. Waarom doen jullie activiteiten/lessen omtrent natuur?

Appendix 4: Questionnaire parents

English version

Questions concern the child that has been interviewed for the research

1. Do you spend a lot of time in nature together with your child? Can you give some examples?
2. How much time do you spend with your child in nature per month (estimated mean)?
 - Less than half a day
 - Half a day up to 2 days
 - 2 – 5 days
 - More than 5 days
3. Why do you take your child out into nature? Or why not?
4. Does your child enjoy the activities you do together in nature?
5. Does your child spend a lot of his or her own time in nature? Do you know what he or she does outside?
6. How much of his or her own spare time does your child spend in nature/outside per week (estimated mean)?
 - Less than 3 hours
 - 3 – 7 hours
 - 7 – 14 hours
 - More than 14 hours
7. Do you stimulate your child to go out into nature? Why (not)?
8. Are you concerned about nature and the impact of humans on the planet? Why (not)?
9. Do you talk with your child about topics like climate change, biodiversity and deforestation? Why (not)? And if yes, how do you approach this?
10. Do you think the school of your child plays an important role in the interest for nature? Please explain your answer.

Dutch version

Deze vragen gaan over uw kind dat heeft deelgenomen aan het onderzoek over natuur op school

1. Besteedt u samen met uw kind veel tijd in de natuur? En kunt u daar een aantal voorbeelden van geven?
2. Kunt u aangeven hoeveel tijd per maand u met uw kind in de natuur bent (geschat gemiddelde)?
 - Minder dan een halve dag
 - Een halve dag tot 2 dagen
 - 2-5 dagen
 - Meer dan 5 dagen
3. Waarom neemt u uw kind mee de natuur in? Of waarom juist niet?
4. Vindt uw kind de activiteiten die u samen onderneemt in de natuur leuk?
5. Besteedt uw kind veel van zijn of haar eigen tijd in de natuur? En indien u dit weet, wat doet hij/zij dan zoal?
6. Hoeveel tijd brengt uw kind (gemiddeld) buiten/in de natuur door in zijn/haar vrije tijd?
 - Minder dan 3 uur per week
 - 3-7 uur per week

- 7-14 uur per week
 - Meer dan 14 uur per week
7. Stimuleert u uw kind om de natuur op te zoeken? Waarom wel of niet?
 8. Maakt u zich zorgen over de natuur en de invloed die de mens hierop heeft? Waarom wel of niet?
 9. Heeft u het met uw kind thuis over onderwerpen als klimaatverandering, biodiversiteit en ontbossing? Waarom wel of niet? Indien ja, hoe pakt u dat aan?
 10. Denkt u dat de school van uw kind invloed heeft op de interesse van uw kind voor de natuur? Kunt u uw antwoord toelichten?

Appendix 5: Legend Nature connectedness table

Definition of nature	1=least inclusive definition of nature, 4=most inclusive definition of nature
Human-nature relationship	4=most inclusive (towards oneness with nature), 1=most distant/utilitarian/anthropocentric
Enjoyment of nature	1=least enjoyment, 4=most enjoyment
Time spent in nature	1=least time spent in nature, 4=most time spent in nature
Personal importance of nature Children	1=lowest emotional importance, 4=highest emotional importance
Sense of oneness	1=least profound sense of oneness, 4= most profound sense of oneness
Empathy for creatures	1=least profound empathy for creatures, 4=most profound empathy for creatures
Sense of importance of nature	4=highest sense of importance of nature in a broad sense (towards ecocentric), 1=lowest sense of importance (utilitarian, anthropocentric)
Sense of responsibility for nature	1=lowest sense of responsibility, 4= highest sense of responsibility
Nature connectedness score	Sum of relative nature connection scores divided by nr of NC itmes (9). Highest score means highest nature connection

Appendix 6: Legend Contextual explaining factors table

Nature accessibility	relative distance to nature 1=nature closest by home 4=nature furthest from home
Parents' sense of importance of nature for children	4=most profound importance for wellbeing and development, 1=least profound importance
Parents' sense of responsibility for nature	4= most profound sense of responsibility (awareness, measures, thoughts, important topic in family), 1=least profound sense of responsibility
Role models	4=most positive influence of role models ((grand)parents, teachers, tv, ..) 1=least positive influence of role models