

# Children's Understandings of Environmental and Sustainability-related Issues in Kindergartens in Rogaland, Norway, and Queensland, Australia

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## ABSTRACT

This study compared the understandings of environmental and sustainability-related issues of 4-5-year-old children in kindergartens in Rogaland, Norway, with understandings of similarly-aged peers in kindergartens in Queensland, Australia. Twenty structured conversations with children were undertaken in each country. A qualitative content analysis of these conversations with regard to their contexts elucidated how children experience everyday activities related to environment and sustainability and what they think about adult attitudes and behaviors in relation to these topics. Most of the children in both countries enjoyed being outside in nature; however, they had limited understandings of sustainability-related terms. The Norwegian children seemed to have more frequent and diverse opportunities to explore and to get in touch with nature, while some Australian children had quite sophisticated ideas about sustainability-related relationships and interconnections. Positive adult attitudes and behaviours combined with inquiry-based and language stimulating learning experiences, situated in appropriate social and outdoor contexts, offer potential to promote children's understandings of sustainability.

**Keywords:** children's understandings, sustainability, environment, kindergarten, Norway, Australia

## INTRODUCTION

Sustainability is defined as a “*development that meets the needs of the present without comprising the ability of future generations to meet their own needs*” (WCED, 1987). Research in early childhood education for sustainability (ECEfS), especially since the United Nation's Decade for Education for Sustainable Development 2005-2014 (UNESCO, 2012), underlines the need to acknowledge and to follow up children's thoughts, questions, ideas and understandings related to sustainability (Ärlemalm-Hagsér & Sundberg, 2016; Ärlemalm-Hagér & Elliott, 2017; David & Elliott, 2014; Engdahl, 2015; Heggen, et al., Accepted/2019). Children can and do play important roles in contributing to a sustainable society, both as current and future agents of change (Bell, 2016; David & Elliott, 2014; Heggen et al., Accepted/2019). The UNESCO Agenda 2030 aims to empower children and youth, and to provide them “*with a nurturing environment for the full realization of their rights and capabilities*” (UNESCO, 2015, targets 23. and 25.).

Earlier research have revealed young children's perspectives on specific topics and understandings of concepts related to sustainability (Borg, 2017; Hammond, Hesterman & Knaus, 2015; Kahriman-Öztürk,

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**Article History:** Received 15 May 2019 ♦ Revised 18 July 2019 ♦ Accepted 18 July 2019

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Olgan & Güler, 2012; Kos, Jerman, Anzlovar & Torkar, 2016; Palmer & Suggate, 2004). A further uncovering of young children's perspectives may provide kindergarten teachers with valuable feedback related to their sustainability related programs, and may assist in the development of memorable activities and practices that ultimately strengthen children's active participation in sustainable development initiatives both now and in future. This study aims to discover kindergarten children's experiences of everyday sustainability-related activities, and their perspectives on sustainability-related issues.

This study compared the understandings of sustainability-related topics amongst young children (4-5-year-olds) in two different kindergarten environments, one from Rogaland, Norway, and the other from Queensland, Australia (Sageidet & Davis, 2014). Based on guided conversations with twenty children from each of the two countries, this study elucidated how children experience and understand everyday activities related to sustainability, what they think of adult attitudes and behaviors in relation to sustainability, and how the children's feedback may be used to develop and follow up on sustainability-related educational programs in the kindergarten.

## CONTEXTUAL BACKGROUND

### Norway and Australia

Both Norway and Australia have a child-centered approach to early childhood education, based on sociocultural theory (Vygotsky, 1986), that views the child as an active, capable and competent change agent (Weldemariam, et al., 2017). Both national early childhood education curricula meet international standards outlined by the OECD (2006).

Each countries' Early Childhood Education Frameworks also have clear and explicit integration of sustainability, including values related to social responsibility, respect for and care of the environment, and the embedding of sustainability in daily practices (DEEWR, 2009; Ministry of Education & Research, 2017).

However, the Australian Framework (DEEWR, 2009) deviates from the Norwegian document by recognizing children as future citizens, while 'sustainability as a core value' is specific to the Norwegian Framework (Ministry of Education & Research, 2017). In both countries, many kindergartens are working more-or-less with sustainability-related learning activities, and along with their comparable economic status and standards of living, these countries have similar challenges for developing of such practices (David & Elliott, 2014; Sageidet, 2016).

Norwegian kindergartens have long traditions of outdoor education (Fjørtoft, 2001), and some are inspired by the philosopher Arne Næss' deep ecology philosophy (Næss, 1989, Sageidet, 2014a). Sustainability practices such as recycling, supporting projects for children in developing countries, or specific projects for the 'green flag' certification, have been strengthened along with the Norwegian government's strategy for the promotion of science education, 2015-2019 (Ministry of Education & Research, 2015; Sageidet, 2014a).

In kindergartens in Queensland, Australia, recycling and gardening with the children are common practices, while activities in nature outside of the kindergarten boundaries perhaps occur less frequently, though this is changing as movements such as bush preschools gain traction (Elliott & Chancellor, 2014). In the often drier Queensland climate, kindergartens, preschools and daycare services, and the curriculum documents that support these educational programs, commonly facilitate water play, and also encourage the children to be aware of water being in short supply (Sageidet, 2014b). 'Belonging, being and becoming' is Australia's first ever Framework for early childhood education (DEEWR, 2009). It builds on an inquiry based learning approach, facilitating learning experiences that enable problem solving, exploring, expression of children's own ideas and theories, and investigation of complex concepts (DEEWR, 2009, p. 35; Sageidet, 2014b).

### Children's Understanding of Environmental and Sustainability-related Issues

Research on young children's understanding of specific topics or concepts related to sustainability and the environment is increasing, but still somewhat limited. Kambouri (2016) underlines the importance for teachers to understand children's (pre)conceptions and notions, in order to help them to develop their understandings. A longitudinal study (Palmer, 1995, Palmer & Suggate, 1996, 2004) asked 4-10-year-old children about their understandings of sustainability-related topics including waste materials and global warming. They found that the youngest participants demonstrated both basic understandings and misconceptions. Interviews with 36 kindergarten children about their ideas related to the economic, social and

ecological dimensions of sustainability (Kahrirman-Öztürk, Olgan & Güler, 2012), revealed that the children had difficulties understanding concepts such as: “rethink”, “reflect” and “redistribute”. However, the children did understand more concrete concepts such as: “reduce”, “reuse”, “recycle”, and “respect”. Hammond, Hesterman, and Knaus (2015) discussed poverty and differences in the content of people’s refrigerators with 6-7 years old children. The children’s theorizing about the reasons for peers’ poverty revealed clear associations between work and money and a family’s capacity to provide food. Interviews with 5-6 years old children (Kos, et al., 2016) revealed an initially low understanding of connections between actions, for example, walking instead of driving, or turning off the tap, and their effect on the environment. However, the children developed their understandings as a result of being involved in activities that helped them to make the connections.

## THEORETICAL FRAMEWORKS

### Participative and Active Learning

This study builds on social-constructionist theories (Lave & Wenger, 1991; Vygotsky, 1986) that underline the importance of practical activities and social contexts to promote learning processes in young children, including learning processes for sustainability transitions (Bell, 2016). Formal, informal and unintended contextual learning occurs through participation in social contexts, and the curriculum can be visible through children’s perceptions. Children seek meaningful relationships and try to make connections to their prior knowledge (Lave & Wenger, 1991; Vygotsky, 1986).

Human’s and children’s ‘understanding’ entails having a continuously developing mental model, or cognitive structures, that represents the structure of a concept or phenomenon and can be transferred from one situation to another. A mental model is a representation that provide a workspace for mental operations, and can generate predictions about the world (Halford, 2014, p. 238). Vygotsky (1986) emphasized the importance of language in this connection, while Hope, Schachter, and Wasik (2013) underlines that communication with engaged adults contributes to increase the vocabulary of even very young children. Listening to the children’s voices, appreciation, acknowledgment and respect is necessary to ensure children’s agency and active participation in decision-making and action taking (Engdahl, 2015; Engdahl & Rabušicová, 2011; Johansson, 2011). Children have distinct perspectives or frames of reference, and unique differences, and the concepts they understand, have a strong influence on their developing of strategies, skills, and competences (Halford, 2014). Children’s perspectives are essential to kindergarten teachers’ reflections on their own work, and to the development of inclusive activities and practices that are understandable for children (Davis & Elliott, 2014).

### Children as Global and Ecological Citizens

Global citizenship education is a political, ecological, economic, social and cultural way of understanding, acting and relating oneself to others and the environment in day-to-day contexts, based on universal values, responsibility, the youths’ active participation, critical thinking, and a sense of belonging to a broader local and global community and common humanity (Lee & Fouts, 2005; UNESCO, 2014). The concept includes cognitive skills, socio-emotional skills, and behavioural skills for humankind to learn how to live more sustainable on this planet, and outlines a holistic and transformative approach (Bell, 2016; UNESCO, 2014). The UNESCO (2014) document on ‘Global citizenship education’, outlines a holistic approach, and underlines the global community’s responsibility to preserve the planet Earth (UNESCO, 2015; cf. Næss, 1989). As members of the ecological system of the planet, together with all other biotic participants, ecological citizens are critical of the ways how humans use and share resources and recognizes intergenerational equity issues (van Steenbergen, 1994; Dean, 2001; cf. WCED, 1987; UNESCO, 2015).

The literature relates children’s environmental development to experiences and sustainability-related learning activities in nature (Årlemalm-Hagsér & Sundberg, 2016; Davis & Elliott, 2014; Fjørtoft, 2001). Thus, children with an active identity as ecological citizens may feel an initial sense of belonging to our planet, including the more-than-human world, and may develop a desire of care, solidarity, curiosity, and knowledge (Bergersen, 2016; Davis & Elliott, 2014; Heggen et al., Accepted/2019; Weldemariam et al., 2017). This may promote children being and becoming active and informed members in a sustainable society (Heggen et al., Accepted/2019). Ecological citizens have the right that provide for the protection of the individual against the effects of pollution and environmental degradation (Dean, 2001; UNESCO, 2015). According to Lave and Wenger (1991), ‘newcomers’ (for example children) in a community of learners, have a role as agents of change, both on the level of personal development through engaging in existing practices, and through the establishing

of their own identity as future members of the community (Lave & Wenger, 1991, p. 115). This community may be the group in the kindergarten, or the broader community of global ecological citizens. Heggen et al. (Accepted/2019) explored children's ecological citizenship through an interdisciplinary focus on sociocultural activities in nature, inquiry based social and ecology learning, play, curiosity, children's literature, and gardening as a local possibility for social, ecological and sustainability learning (cf. Bell, 2016; Desmond, et al., 2004; cf. Sageidet, 2014b).

## METHODOLOGY

### Research Question

This study sought to explore the research question: How do 4-5-year-old children from Rogaland, Norway, and from Queensland, Australia, experience and understand sustainability-related topics and activities in their kindergartens?

### Study Process and Data Collection

This qualitative study involved 40 guided, structured conversations (Clark, 2017; Clark et al. 2014; Mayring, 2014) with 20 children aged 4-5-year-old from three kindergartens in Rogaland, Norway, and 20 children from three preschools in Queensland, Australia. Both preschools and kindergartens are referred to as "kindergartens" for this study. All the participating kindergartens had a focus on sustainability, including recycling and gardening programs. Regarding research participation, the centers sent out information to parents, who were invited to discuss and decide, together with their child, whether to give their permission to participate in an interview or not. The study, the information material for parents, and a conversation guide has been approved by the Norwegian Center for Research Data (NSD), and the Australian University's Human Research Ethics Committee (UHREC).

The researchers understand themselves as co-learners, embedded in their own sociocultural framework, when spending time with the children in their kindergarten settings ahead of the conversations, when listening to the children, as well as during the data analysis (Clark, 2017; Clark et al., 2014; Vygotsky, 1986).

One of the Australian researchers conducted the conversations with the children in Australia, while the Norwegian author conducted the conversations with the children in Norway, both using a conversation guide (see 'Methods and analysis'). The researchers spent considerable time with each child for becoming acquainted prior to the guided conversation, and they respected each child's agenda in relation to the duration and location of the conversation. Each conversation with each child lasted approximately 20 minutes. Each child met the researcher in a known setting in her/his kindergarten, together with a known kindergarten teacher. Each child was introduced to the study's purpose and to the use of audio recording. If any signs of discomfort for the child were recognized for example feelings of stress or anxiety, or inconvenience for giving up time from play, the conversation would be terminated. The child could withdraw at any stage of the research process. The children's responses were audio-recorded, and later transcribed under pseudonyms. All information was handled confidentially and individual identifiers were permanently removed after the data collection. The data were collected from 2014 to 2016. The kindergarten staff contributed with organizational help, but this study did not consider any information they gave related to the interview questions, because the intent of the conversations was not to "check" whether the children's responses were "right" or "wrong" (cf. Kahrman-Öztürk, Olgan, & Güler, 2012; Miller et al., 2014).

### Methods and Analysis

This study used a structured conversation guide with questions, while the phrasing could vary in each conversation (cf. Mayring, 2014, p. 57). Key areas for ethical considerations include the active listening to, and respecting the children's verbal and nonverbal individual expressions and reaction; the rephrasing of questions if necessary to make them understandable for each child; paying close attention to adapting the conversation context to ways that seem to make sense to and be comfortable to each child (Clark et al., 2017). For example, some children preferred to 'guide' the researcher to specific places during the conversations.

All 40 conversations were analysed by use of directed and summative content analysis (Hsieh & Shannon, 2005). In an approach to further develop fragmented earlier knowledge, the study explored qualitatively the contextual use of words and the conversations' content, thereby, including quantitative aspects and numerical data, and their underlying meaning (Hsieh and Shannon, 2005; Mayring, 2014). The study tried to be aware

**Table 1.** Overview of some of the children's answers

	Norwegian children			Australian children		
	yes	no	ind	yes	no	ind
<i>Do you like to be outside?</i>	13	4	3	13	5	2
<i>Do the adults in your kindergarten like to be outside?</i>	17	1	2	16	1	3
<i>Do your parents like to be outside?</i>	14	3	3	13	4	3
<i>Do you know what rubbish is?</i>	19	1	-	20	-	-
<i>Do you sort or collect rubbish in your kindergarten?</i>	13	5	2	17	2	1
<i>Do you sort or collect rubbish at home?</i>	10	4	5	15	1	3
<i>Do you think we should try to use less water?</i>	11	7	2	16	4	-
<i>Do you think we should try to use less paper?</i>	6	7	7	12	5	3
<i>Do you think we should try to use less electricity?</i>	10	4	6	14	4	2
<i>Do you have a garden in your kindergarten?</i>	13	7	-	20	-	-
<i>Do you know the meaning of the word "compost"?</i>	3	16	1	12	7	1
<i>Do you separate compost in your kindergarten?</i>	8	5	7	13	1	6
<i>Do your parents take care of nature?</i>	10	4	6	16	1	3
<i>Can children take care of nature?</i>	10	9	1	14	1	5

(Abbreviation: ind = indefinite; that is to say the children didn't know or didn't answer or both)

of the researchers' preunderstandings and preconceptions, that is to say their professional and cultural perspectives and personal biases, including (unconscious) expectations and beliefs, and power resources (Mayring, 2014, p. 49; Bae, 2005). These may influence the reflective act of interpreting (Mayring, 2014).

Within a descriptive qualitative research design (Mayring, 2014), the themes 'being outside in nature', 'recycling and conservation', 'garden use and composting', and 'learning about nature and taking care of nature', derived as deductively-formulated categories from the researchers' perspectives on the theory of intertwined ecological, economic and social dimensions of sustainability (UNESCO, 2012), inspired by earlier studies (Kahrman-Öztürk, Olgan & Güler, 2012; Mayring, 2014, p. 12; Palmer & Suggate, 2004). Inspired by the same earlier studies, in addition to the researchers own practice observations, theme-related questions were devised for the conversation guide (cf. Clark, 2017), addressing sustainability in children's everyday life in their kindergartens, including some home settings. Thereby, kindergarten and home were acknowledged as interrelated parts of the children's everyday life and sociocultural contexts (cf. Vygotsky, 1986).

These theme-related questions (see 'Analysis and discussion') were then used as subordinate coding categories for the analysis. The three-step analysis process started with a thorough familiarizing with the data through multiple reading in order to understand the children's experiences and perspectives, and to identify 'deep' information from the personal conversations (Creswell, 2005). In a second step, the predetermined categories were critically re-checked, considering the data and the (revised) theory, and extended by giving new codes to conversation units that could not be categorized (Hsieh & Shannon, 2005; Mayring, 2014). During the final step of analysis, by working through and coding the transcribed conversations, another focus was set on identifying content-related arguments, while possibly procedurally-emerged arguments were critically reevaluated, to maintain validity (cf. Mayring, 2014, p. 41). The results from Rogaland, Norway, were then compared with those from Queensland, Australia, with the researchers being aware that this directed approach may imply a tendency to find theory supportive evidence rather than non-supportive. Also, some children might feel motivated to answer in a certain way, to please the researchers (Hsieh & Shannon, 2005; Mayring, 2014).

The results were presented in a form of brief sketches, similar to narratives (Chase, 2013). In order to provide an overview, the children's positive or negative responses to some of the questions are summarized and visualized in a table (Table 1).

## RESULTS AND ANALYSIS

### Theme 1: Being Outside in Nature

#### *Questions: Do you like to be outside? What are you doing outside?*

Most of the Norwegian children liked to be outside, and thought that the adults in their kindergartens and their parents would also like to be outside (Table 1).

To elaborate on the data from the Norwegian children, Sondre, Brage and Solveig definitely did not like to go for a walk. Sondre explained that this was boring and that he gets tired and sore feet. He preferred to go to a museum or to the beach. Solveig preferred to be inside, even though she attended a nature kindergarten. Howard liked to be outside, because then, "We can do something more fun, and we can do just what we like to do". Nine of the children enjoyed being outside because they can do it together with friends. Torbjørn is ambivalent to going for walks, since he then may not be with friends. He preferred to have a popcorn party. Tobias did not like being outside because it is cold. He did not like walks to the woods, because he is afraid of falling off a tree. Four boys and one of the girls especially liked to climb trees. Håkon liked to pick flowers and to find rats in the woods. Torbjørn said, "I like to go to the beach, to the sea, for to catch shrimps and fish". Howard remembered from an excursion, "There was something which looks like a bird leg, but it was not, it was bird dropping, and that I did not liked so good".

Five of the 20 children described a walk, an excursion or a boat trip as their favorite activity, for six of the children this was birthday parties, while the others mentioned cycling, swinging, hopping, climbing in trees, playing with sand or a friend, preparing food, drawing, collecting, sorting, making soap bubbles, reading, and having school preparation activities. For Howard a drama activity was his favorite, when he and a friend of his were riders. For Ingrid and Solveig their favorite thing to do was the recent fire emergency trainings in their kindergarten. Tuva said that her parents like to cycle with her outside, while most of the Norwegian children had little to tell about their parents with regard to outside activities or preferences.

Most of the Australian children liked to be outside and thought that the adults in their kindergartens and their parents would also like to be outside (**Table 1**). Sally liked running and skipping outside, but she did not like the sun getting in her eyes when she was looking at the sun. Melvin liked playing outside, with bikes or hide and seek. Susan liked picking flowers. Hannah preferred to go for a walk when she is outside, while Lizzy liked jumping. Oliver liked to make a special rocket outside, Evelyn and Sarah liked to make volcanoes in the sand pit, while Jacob liked to find fossils in the dirt. Edward is afraid of the lizards outside, "because they bite you".

Favorite outside activities for seven of the 20 Australian children included playing with games, sand or water play, and painting. Peter liked best to work with wood; Evelyn liked to play by the trees, while Oscar and Henry liked best to build bush cubby houses. Mary and Lizzy liked helping and tidying up. Writing, looking after snakes, picking up rubbish, watering the garden, and flushing the toilet were favorite activities for five other Australian children.

Three of the Australian children believed that the adults in their kindergarten like fresh air, trees, and doing the garden. Susan told that her parents prefer to be outside or inside, respectively. Seven of the children told that their parents like to play together with them outside. Henry told that his parents like to move rocks and cut off tree branches together with him. Five children thought that their parents like to work in the garden. One of them told that her mother uses to put clothes on the line outside. Peter commented that his father likes to be outside because he always thinks about building something.

## Theme 2: Recycling and Conservation

### Question: Do you know what rubbish is?

Nearly all of the Norwegian children could comment when asked about rubbish (**Table 1**), and nine answered that rubbish is 'what we put in the bin'. Other suggestions were: paper, damaged or ugly things, cardboards, food, corks, diapers, yoghurt, glass, old socks, and old fish. Howard explained, "Rubbish is something that we can throw into the bin, so the removal van will come and put it into a rubbish machine, so it gets away". Mette explained that rubbish is "something which animals cannot accept... Fishes does not bear plastics". Two boys answered that rubbish is something dangerous for nature. Solveig from the nature kindergarten stated, "those who throw rubbish on the floor, have to pick it up again".

All of the Australian children knew about rubbish (**Table 1**), and ten associated rubbish with plastic, while six children referred to boxes. Other suggestions were: straws, food, banana skins, orange skins, tin things, glass, milk and bottles. Lizzy stated that rubbish is "stuff that you don't use any more. And you put them in the trash cans, and then they get used for something else". Melvin said, "rubbish is to recycle...". He explained that you can make paper into new paper. Two of the Australian children believed that rubbish is something people don't like or don't use. Susan explained, "rubbish can blow away in the wind and go into the water and then it will flow on top and a turtle might eat it". Oliver pointed out that "plastic bags...can make creatures very sick in the water, in the sea or the lake... don't give them to animals". Henry told, "It's like when you get

some food and it's covered with something or you've got something and there's like a wrap around it. And when you're at the sea and you've got a plastic bag, don't drop it in the sea....If the animals drink it or eat it or go near it, they can die".

**Question: Do you sort and collect rubbish in your kindergarten and at home?**

More than half of the Norwegian children answered positively to this question (**Table 1**), but only few of them had further comments or explanations to this question. Alma explained, "yes, when we have had group time, ... metal shall be collected, not into the same bin, ...we have had many [different] bags... [but] we put everything in the same bag".

Most of the Australian children said that their kindergartens sort and collect rubbish (**Table 1**). Eleven of the children associated the question with recycling. Three of the children told that they have a worm farm in their kindergarten. Sally explained that her kindergarten's worm farm is for scraps, and they have chicken bins for crust, a recycling bin for paper and a rubbish bin. Hannah reported that they do not have different bins at her kindy, but that the rubbish "gets recycled around". Hannah told about her home; "last week I helped the turtles because there were some rubbish in the sea and we got the rubbish quickly". Susan told that "a truck comes along and picks up the bin, ..."

**Question: Do you think we should try to use less water, paper, and electricity?**

**Table 1** gives an overview of the Norwegian children's answers. Tuva told that her mum and dad used to say "don't use all the water". Mette told, "we drink water from the sea, and there is a lot of salt in the sea, and so suddenly, there will be no sea longer, and so we will not have water any more". Solveig told, "in our family, everybody should have a shower, but Emma used all the warm water, so the others had to have a shower with cold water....but the water is never empty". Elisabeth said, "if the water is empty, so we do not have water to drink. ... When we have had a shower, the electricity had gone, so mum could not have a shower".

Sondre and Ingrid pointed out that we need electricity for the light and the iPad. A boy said, "Electricity is just going on". Alma and Torbjørn associated this concept with saving teddy bears or sweets, respectively. Brage said that his mum saves money for a house. Solveig explained that when we use all of the battery, there will be nothing left, and we do not have any electricity any more.

**Table 1** gives an overview of the Australian children's answers. Alice explained, "We have to save the water and the electricity because we have to pay for it". Sally said, "We should save the electricity... Because you might waste a lot of water and you might watch a lot of TV". Evelyn explained, "we should not waste water because then you'll die", Sarah, Jacob and Lizzy thought about saving food for to eat it later. The Australian children had less comments on this issue than the Norwegian children.

### Theme 3: Garden Use and Composting

**Question: Do you have a garden in your kindergarten, what grows there, what do you like to do there?**

A numerical summary of the Norwegian children's answers to this question is also shown in **Table 1**. Some children from the same kindergartens gave different answers to the question whether their kindergarten had a garden. All but two of the children from Norwegian kindergartens spoke about the plants in their kindergarten gardens: flowers (6 answers), leaves (5 answers), plants (3 answers), redcurrants (2), plum and apple trees, carrots, cress, tomatoes, and sunflowers. All but one of the children said that they liked to be in the garden, but four children did not answer. Eleven of the children mentioned watering the plants, nine of the children mentioned planting, and five of the children mentioned playing as their favorite activities in a garden. Torbjørn said that he likes to eat seeds.

All of the 20 Australian children knew that they had a garden in their kindergarten (**Table 1**). In these gardens grew: strawberries (8 answers), tomatoes (5 answers), carrots (4 answers), lettuce (3), bananas (3), pineapples (2), blueberries, flowers, radishes, zucchini, corn, oranges, beans, and parsley. Apart from one child, all children expressed that they like to be in these gardens. Susan, Alice, Jacob, and Howard said that they liked to play in the garden. Hannah liked to work in the garden, she told, she likes to "put seeds in and put water". Evelyn and Mary also like planting and watering. Sarah said that she likes "dig holes for the plants". Edward liked to help with the garden. Kate and Isabel liked to pick flowers and tree branches. Lizzy told about a chicken garden at her kindergarten, "They grow eggs, but it's not like plants". Sally told, "I like watering and I like to collect eggs". Peter and Oscar said that they liked patting the chicken and collecting the eggs.

**Questions: Do you know the meaning of the word “compost”? Do you separate compost in your kindergarten or at home?**

Only three of the Norwegian children knew the term “compost” (Table 1), while four of them tried to provide an answer but revealed a misunderstanding. Stian described compost as “old leaves and old food”. Hilde explained compost as “such glass pieces, bad fish”. Less than half of the children knew that their kindergarten separates food garbage (Table 1). Ingrid commented that she has planted carrots and tomatoes at home. She likes to play and to cycle in the garden, and having fun.

Twelve of the Australian children shared comprehensive understandings of compost, and thirteen of them reported that their kindergarten separated compostable materials (Table 1). Melvin defined compost as, “It means you put stuff on the garden”. “It means that you can put in onto plants and they stay alive,” answered Alice. Henry and Lizzy associated compost with food scraps. Sally explained, “I put [food scraps] in the compost...worms eat them and make worm juice...It makes the garden grow”. Peter explained, “Worms eat it, Worms live in compost....we put it around our banana trees...”. Eight other children related the worms and worm bin with compost. Susan, Alice, and Jacob explained that compost gets into dirt.

**Theme 4: Learning about Nature and Taking Care of Nature**

**Question: How do you think nature can be destroyed?**

Most of the Norwegian children had no suggestions about how this could happen. Several children associated the question with picking up waste/not to throw away waste (in the woods), or with collecting bottles. Four children associated the question with trees that can fall down, three children with thunder, and one with fire. Jonathan knew that nature gives us air to breathe. Two of the children said, “people can be damaged”.

Five of the Australian children answered that this could happen if nature is ‘hit’ or if people hit other persons. Three children related this question to rocks, and three to rubbish, and one of them said that “rubbish might blow into the water and turtles might think that it might be a jellyfish and they just eat it. And it might get stuck. And they’ll just flow up to the very top of the water, and then they’ll die”. Sarah answered “and Lizzy said that this is “like if a bad guy [...] have a gun and starts shooting”.

**Questions: Do your parents take care of nature? How do they do this?**

Ten of the Norwegian children thought that their parents do take care of nature (Table 1). One of the boys said that his parents put things in the bin, and one of the girls spoke about how her parents do take care of nature by fishing together with her. She said “children are able to fish ...”.

Sixteen of the Australian children thought that their parents do take care of nature (Table 1). Two of the children associated this question with their parents work. Melvin said that his parents make the dinner, Edvard said that his parents pack away his toys, and Oscar said that his parents clean up. Three of the children answered that their parents would do some kind of garden work. Rose said that her parents, “like to help people, and [her] dad is a lifesaver”. Susan pointed out that her parents, “when [a named relative] is dead, ... are going to his grave and stick flowers on it”. Henry, Kate and Isabel answered that their parents do take care of them.

**Question: Can you tell me about anything you have learned about taking care of nature?**

Only five of the twenty Norwegian children told what they had learned, for example names of trees, information about the woods, animals, poison fruits, how to pick up garbage, how to water plants, and how to feed cattle. None of the children would like to – or were able to provide any the details.

Fifteen of the twenty Australian children answered this question, providing examples such as: growing trees, to “make sure that [the environment] gets water and sun”, don’t step on plants, cleaning up, putting the toys where they are supposed to be, don’t throw stuff at windows, and not putting rubbish on the ground. Three girls had learned about taking care of people. Isabel explained, “when people are doing naughty things, I just get them to stop”. Ten of the Norwegian, and 14 of the Australian children thought that children themselves could take care of nature (Table 1).



## DISCUSSION

### Children's Experiences of Being Outside in Nature

There is a very similar distribution of outdoor versus indoor preferences among the children of both countries, in spite of different climates, cultures and histories. Most of the children in this study liked to be outdoors, but some children did not like it. The Norwegian children made more comments about longer walks outside of the kindergarten, and some of them did not like it, possibly because they have uncomfortable experiences with such walks. Kindergarten teachers should acknowledge children's unique differences, emotions, personal levels of mastery, and possibly different geographical or cultural frames of references about nature (Henson, 2003; Sageidet, Almeida, & Dunkley, 2018), and should help each individual child to develop her/his own personal relationship to nature and the outdoors (Fjørtoft, 2001; Henson, 2003; Ministry of Education & Research 2017). Several children from both countries emphasized being with friends and having fun as important in connection with outside activities.

Many Norwegian kindergartens have a strong focus on nature and outdoor activities (Fjørtoft, 2001, Sageidet, 2016), and children spent a lot of time outside. The outdoor activities, mentioned by the Norwegian children – such as climbing trees, finding rats or bird droppings, catching shrimps and fish, and picking flowers - seem to reflect that they have many and diverse opportunities to explore, and to be closely in touch with nature. This Norwegian tradition may inspire kindergartens, independent of country, climate or urban versus rural locations, to provide children with more opportunities to connect with nature and thereby to the more than human world (Næss, 1989; Sageidet et al., 2018; Weldemariam et al., 2017).

Playing with games, sand or water, and looking after snakes, are among the favorite outside activities for the Australian children. Some Australian children's statements such as making "special rockets" and "volcanoes", finding "fossils" or "working with wood", "picking up rubbish", and "helping and tidying up", may give the impression that the outdoor activities in Queensland's kindergartens possibly have a somewhat stronger relation to science learning and adult guidance (cf. DEEWR, 2009).

From a holistic, interdisciplinary and social-constructionist perspective, all of the 40 children's personal preferences have potential to help develop sustainable understandings (Bell, 2016; cf. Vygotsky, 1986; UNESCO, 2012, 2014). While putting their preferences in action, the children get opportunities for language development, problem solving, and the formation of thought constructs and cultural understanding (Hromek & Roffey, 2009; cf. Lave & Wenger, 1991). Some children's favorite things to do are exciting activities such as making soap bubbles, and having parties, drama play and fire emergency training. Hromek and Roffey (2009) explain that there is a "natural affiliation between children, play, and the desire to have fun" (Hromek & Roffey, 2009, p. 626). Social and emotional learning is related to well-being, an issue that is addressed by the third sustainable development goal (UNESCO, 2015), and may be related to the development of values, attitudes and everyday behaviors through global citizenship education (Hromek & Roffey, 2009; Lee & Fouts, 2005; UNESCO, 2014).

### Children's Understandings of Recycling and Conserving

The children from both countries showed a fairly complex understanding of rubbish. About half of all children interviewed seemed to have an initial understanding of the term "recycling". Several of the children, mostly from Queensland, had advanced understandings of recycling, garbage, and food cycles in nature with their threatening consequences for animals.

Most of the Norwegian, and nearly all of the Australian children were knowledgeable about the rubbish collection and sorting at their kindergarten, but only half of the children in both countries were aware of such practices at home. Nevertheless, the statement of Alma, who sorted rubbish "... when [she] had group time...", seem to confirm that children may see occasional collecting or sorting of rubbish as a kind of categorizing activity, while regular recycling activities would make them familiar with it (Kahrman-Öztürk et al., 2012).

Saving of water was familiar to the children in Australia, where drought can impact upon the communities where the children live. The Norwegian children seemed to be uncertain about problems related to water use, as fresh water is an abundant resource in Norway. They seemed to be more familiar with restrictions on availability of warm water. Several children of both countries had some understandings of a need to save electricity, for example in relation to warming up water, having light, using electronic equipment, and saving money.

The Australian children seem to be a little more familiar with saving paper, but none of the children in both countries commented on this issue. Kambouri (2016) underlines the demanding role of early childhood teachers to respond to the children's conceptions, to develop their scientific understanding, and to encourage the children to share their ideas and to construct and develop their learning together (Ahi, 2017; Kos et al., 2016; cf. Lave & Wenger, 1991).

### Children's Understandings of Garden and Composting

Long periods during the year without gardening activities, may be one of the reasons why many of the Norwegian children seemed unsure whether their kindergarten had a garden or not. Some of the garden plants, mentioned by the Norwegian children – leaves, trees, grass - suggest a broad understanding of what was associated with a garden. Most of the Norwegian children liked to be in a garden: playing, watering, planting plants, and/or eating seeds. According to an earlier study (Sageidet, 2016), 60 % of the Norwegian kindergarten teachers had an interest for gardening, but they used it seldom in their kindergartens. Gardening in kindergartens is a rather slow upcoming trend in Norway (Sageidet et al., 2018), while it is common in Australia (Sageidet, 2014b). All the Australian children were sure about having a garden in their kindergarten, and nearly all liked to be there. Several children spoke about their involvement in garden work, or with their kindergarten's chicken coup. Fewer than half of the Australian children, but most of the Norwegian children, did not know what compost is, but some from both countries had a good understanding. More Australian than Norwegian children knew about separating food scraps at their kindergarten.

The children in this study do seem to seek meaningful relationships related to gardens (cf. Sageidet et al., 2018), and they make connections to their prior knowledge or – in the case of Lizzy and the growing “eggs” – they make connections to their own misconceptions (Henson, 2003; Kambouri, 2016; cf. Lave & Wenger, 1991). Gardens can provide play opportunities, skills and sensory perception that may lead to the permanent retention of knowledge, and may awaken and unfold the child's interests (Desmond, Grieshop, & Subramaniam, 2004). Garden use provides multiple possibilities for practicing and understanding of sustainability (Bergersen, 2016; Sageidet et al., 2018), and gardening in Australian kindergartens could inspire Norwegian kindergartens.

### Children's Understandings of the Taking Care of Nature

Most of the Norwegian children had very limited understanding of the issues related to taking care of nature. They had a vague understanding of the term “nature” and alternative questions were necessary to get some responses. The researcher in Queensland used the term ‘environment’ instead of ‘nature’. The term ‘nature’ occurs four times in the Australian curriculum (DEEWR, 2009), and 42 times in the Norwegian Framework Plan (Ministry of Education & Research, 2017). Several of the Norwegian children associated the question with the woods, from where they may have their own socio-cultural experiences as their reference frame (cf. Henson, 2003). The Australian children seem to have a broader understanding of taking care of nature, including taking care of other people and using social competences, actions and ways of thinking that identify the children as being responsible citizens (Bell, 2016; cf. Heggen et al., Accepted/2019).

Perhaps, this difference can be explained by the Norwegian kindergartens traditionally giving priority to the ecological dimension of sustainability (Fjørtoft, 2001), while the social dimension possibly has been less in focus. As a comparison, investigations in Swedish kindergartens revealed both a more or less missing of the social dimension of sustainability (Ärlemalm-Hagsér & Sundberg, 2016), and a fairly good recognition of this dimension (Borg, 2017).

Most of the Australian children and half of the Norwegian children thought that their parents do take care of nature, but they had a vague understanding how this might happen. We may imagine an untapped sustainability related home “curriculum” through the children's perceptions (cf. Borg, 2017; Sageidet et al., 2018). Some Australian children seem to associate their parents' care for nature with their daily work or care for other people. It is interesting that more than half of all children felt competent to take care of nature (cf. Johansson, 2011; Heggen et al., Accepted/2019).

### Children's Understandings of Concepts and Interrelationships

Most of the children in both countries seem to have some basic understandings of terms like ‘nature’, ‘environment’, ‘rubbish’, ‘compost’ and even ‘garden’, but a starting understanding of the term ‘recycling’. Even if the concept of electricity is challenging for 4-5-year-old children (Kos et al., 2016), kindergarten teachers

should provide opportunities for the children to develop their curiosity for initial explorations of phenomena like electricity (Ahi, 2017; Sageidet, 2012).

The restricted data of this study seem to give a slight impression that the Australian children may be somewhat more accustomed to adult guided conversations and activities, even if this issue would need further investigations. However, this study confirm a close relation between language skills and the children's ability to give an oral expression of their understandings (Bergersen, 2016; Sageidet, 2012; Vygotsky, 1986), and language stimulation and 'giving names' to things may sharpen the children's attention.

Social and exciting events such as drama plays, parties, and emergency training, or making volcanoes or soap bubbles, were obviously memorable for many children of this study. According to Robson (2012), social and exciting settings may support the children's remembering of the information (Ahi, 2017; Hromek & Roffey, 2009; cf. Lave & Wenger, 1991).

Once, the children involved in this study had understood an interrelationship, for example between turtles or other animal's life and discarded plastic bags, they seemed to remember it well and they were eager to discuss their knowledge. Possibly the children recalled their mental models (Halford, 2014). The finding is similar to the results of Palmer and Suggate (1996, 2004) who found that factual knowledge seems to be more robust than misconceptions as children get older.

## CONCLUDING IMPLICATIONS AND SUGGESTIONS

As expected, there were marked variations between individual children's experiences and understandings of sustainability-related topics and activities, and their ability to communicate them, regardless of whether they came from Norway or Australia. Most of the children of this study enjoyed being outside, preferably in social settings, while some children were not comfortable outside. The Norwegian children seemed to experience more frequent and diverse opportunities to explore and to get in touch with nature, while some Australian children had quite sophisticated ideas about sustainability-related relationships and interconnections. Several children from both countries showed fairly complex understandings of rubbish and recycling. Saving water and paper was somewhat more familiar to the Australian children, while children from both countries could relate some of their everyday experiences to saving electricity. The children's understandings of conserving seemed closely related to their everyday involvement with any kind of saving. Nearly all children liked to be in a garden, yet, there is an untapped potential to develop sustainability related garden activities with children.

Most of the Norwegian and Australian children thought that the adults in their kindergarten, as well as their parents, like to be outside. The Australian children seemed to have better expression about what the adults are doing outside, including some gendered associations (one's mother seemed to like hanging clothes in the garden, another's father liked to build things), while the Norwegian children seemed to have rather restricted understandings of their parent's sustainability related attitudes and behaviors. Adult guidance has a great potential for children's learning (Borg, 2017), however, the adults need to be aware of being role models (Lave & Wenger, 1991; Sageidet, 2012). Further research may investigate interrelations between parents' and other adult's actual sustainability related behaviors and attitudes and children's understandings, and how children's understanding may be developed by a closer collaboration between the kindergarten and the children's home.

The children's experiences and understandings and the way they were communicated in this study, may contribute to the further development of sustainability related programs in kindergartens. Kindergarten teachers should not hesitate to discuss the complex concepts and interrelationships associated with sustainability. Gardening, keeping chickens or other animals, food preparing, paper production, waste removal and water education, have great potential to provide young children with understandings of interrelationships and cycles in nature and culture (Kos et al., 2016; Miller et al., 2014; Sageidet, 2014b). Such activities may also develop practical sustainability-related competencies, like collaboration skills, social skills including the development of a sense of responsibility, and simple mathematical/economical skills, thus integrating the ecological, social and economic dimensions of sustainability in kindergartens (Årlemalm-Hagsér & Sundberg, 2016; Davis & Elliott, 2014; Bell, 2016; UNESCO, 2012, 2014). These activities may also promote the children's feeling as members of the world's ecological and social community, and perhaps even their identification as ecological citizens (Bell, 2016; DEEWR, 2009; Heggen, et al., Accepted/2019; UNESCO, 2014).

Kindergartens of both countries may increase children's understandings of environmental and sustainability-related issues by further developing appropriate learning experiences which need to provide frequent and diverse, contextually appropriate and language stimulating opportunities for young children to be valued contributors in complex discussions and experiences exploring multifaceted sustainability interrelationships. Thus, this study may support and strengthen children as ecological citizens.

## ACKNOWLEDGEMENT

Many thanks for participation to the kindergartens and preschools in Rogaland, Norway, and Queensland, Australia, respectively. Many thanks to anonymous reviewers for comments on earlier drafts of the manuscript. Many thanks to the research group "Transnational Dialogues in Research in Early Childhood Education for Sustainability, TND" for inspirations and collaborations. Many thanks to Nora Therese Sageidet for the transcription of the audio recordings.

This study is financed by the University of Stavanger, Stavanger, Norway, and the Queensland University of Technology, Brisbane, Australia.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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