Caring for People and the Planet
Preschool Children’s Knowledge and Practices of Sustainability

Farhana Borg
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The highest education is that which does not merely give us information but makes our life in harmony with all existence.

*Rabindranath Tagore, Nobel Laureate in Literature*

We cannot solve our problems with the same thinking we used when we created them.

*Albert Einstein, Nobel Laureate in Physics*

*Dedicated to my husband, Johan, and our beloved sons, Joseph, Jonathan and Joshua.*
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Abstract

Children across the globe today are continuously being exposed to and affected by various kinds of real-world complexities and challenges; however, research on their knowledge and practices in terms of sustainability is limited, in particular with regards to how preschool- and home-related factors are associated with their learning for sustainability. Since 1998, different types of eco-certification have been awarded by the Swedish National Agency for Education and Keep Sweden Tidy Foundation to promote education for sustainability (EfS) in all areas of education and learning. Despite certificates having been granted in Sweden since 1998, no studies have been conducted at the national level to investigate whether eco-certification has any role to play in children’s learning for environmental and sustainability issues. This knowledge is important to develop pedagogical activities to engage young children meaningfully in learning for sustainability at preschool. This study was undertaken so as to address this research gap in a Swedish context.

The overall aim of this study was to enhance the existing knowledge about preschool children’s learning for sustainability in Sweden. The objectives of this study have been to investigate and compare the knowledge and self-reported practices of sustainability among children attending eco-certified and non-eco-certified preschools, respectively, and to explore the extent to which preschool- and home-related factors are associated with children’s knowledge and practices of sustainability. Further, this study explored children’s perceived sources of such knowledge. The term ‘knowledge’ in this text refers to the descriptions of children’s ideas and thoughts. Similarly, eco-certified preschool refers to a school that work explicitly with EfS.

The study was designed from a “child’s perspective”: this means that it was designed by adults to understand children’s perceptions and actions. Bandura’s (1977) social learning theory and Bruner’s (1961) iconic (image-based) modes of representation were applied in various stages of the study. A conceptual framework was developed within the three-interlocking-circles model of sustainability that illustrates how environmental, social and economic dimensions are interconnected. The concept of sustainability was operationalized in four themes: economic equality, resource sharing, recycling and transport use.

With the use of illustrations and semi-structured questions, final-year preschool children (n=53), aged five to six years, and the directors (n=7) at six eco-certified and six non-eco-certified preschools were interviewed, while guardians (n=89) and teachers (n=74) filled out questionnaires. Qualitative and quantitative data were analyzed using content analysis and Orthogonal Partial Least Squares Discriminant Analysis (OPLS-DA), respectively. The
quality and complexity of children’s responses were assessed and classified using the SOLO Taxonomy (Biggs & Collis, 1982).

The results showed that by the time the children completed preschool, many had acquired some knowledge about how to use money, about the sorting of different recyclable items at home and at preschool, and about the impact of different modes of transport on the environment and people’s lives. They also had ideas about the lives of other children in the world and what it can mean to share resources with other people. There was a positive relationship between children’s declarative (understanding) and functional (practice) knowledge of sustainability issues and the involvement of teachers and guardians in sustainability-related discussions and activities. No statistically significant differences between eco-certified and non-eco-certified preschools in terms of children’s declarative and functional knowledge were found. Parents were reported to be the main sources of children’s knowledge along with the children themselves, teachers and media.

The findings offer support for integrating environmental, social and economic dimensions of sustainability into the daily pedagogical activities of preschools and for giving children opportunities to participate in discussions and practical activities that concern their lives. Further studies are needed to investigate the extent to which different educational activities contribute to developing children’s understanding and behavior when it comes to a sustainable society.

**Keywords**

cconsumption; daycare center; economic sustainability; environmental education; environmental sustainability; guardians; kindergarten; parents; preschool; preschool director; recycling; sharing resources; social sustainability; sustainable development; teacher; young children
List of publications

This compilation dissertation is based on the following four papers, which are referred to by their Roman numerals:

**Paper I**  

**Paper II**  

**Paper III**  

**Paper IV**  
# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tr>
<td>DESD</td>
<td>Decade of Education for Sustainable Development</td>
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<tr>
<td>ECEfS</td>
<td>Early Childhood Education for Sustainability</td>
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<tr>
<td>EfS</td>
<td>Education for Sustainability</td>
</tr>
<tr>
<td>OPLS-DA</td>
<td>Orthogonal Partial Least Squares Discriminant Analysis</td>
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<td>PCA</td>
<td>Principal Component Analysis</td>
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<td>SOLO</td>
<td>Structure of the Observed Learning Outcomes</td>
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<td>UN</td>
<td>United Nations</td>
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<td>UNESCO</td>
<td>United Nations Educational, Scientific and Cultural Organization</td>
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Introduction

Today’s young children are exposed to real-world issues, such as, “dying birds, drowning polar bears, choking smog, urban slums, war and civil upheaval, refugee children and families on leaky boats, or the effects of droughts, floods and cyclones”, which affect them both physically and socially (Davis, 2015, p. 22). They hear conversations about these issues in media and within families, and may even experience such events, which thereby become part of their lives (Davis, 2015).

Living in a time of immense change, such as globalization and digitalization, we require new knowledge to deal with daily complexities, including poverty, gender inequality, unemployment, disparities in opportunity, natural disasters, inequalities within and among individuals and countries, climate change, increases in global temperature and environmental degradation (United Nations, 2015). According to the United Nations Commission on Sustainable Development (UNCSD, 2007), the Ecological Footprint Sustainability Measure indicates that the current global consumption and production levels are 25% higher than Earth’s sustainable carrying capacity. Human beings are living in a state of global systemic dysfunction (Lots-Sisitka, Wals, Kronlid, & McGarry, 2015). Realizing the current complex situation, Wals and Corcoran (2012) have argued that raising awareness about the seriousness of the state of the planet does not ensure a change in behavior or a change in values; rather, alternative forms of education and learning are needed to develop necessary capacities and qualities.

Learning during the early stages of life is considered to be important as individuals in our society carry within themselves patterns of feeling, thinking and acting that they learned when they were young. After such patterns have been established in people’s minds, it is difficult to unlearn them. As the sources of people’s mental program lie within their social environment, the programming begins within the family, and then gradually extends to school, friends, neighbors and the community (Hofstede, Hofstede, & Minkov, 2010).

It is claimed that children are the bearers of values and norms that shape future societies that have a remarkable capacity for conserving their distinctive cultures (Hofstede et al., 2010). Therefore, changing the values and norms of a culture, and ultimately the behavior of the individuals within it, is a daunting task that requires adults not only to change their way of thinking, but also to convey this way of thinking to younger generations, as their attitudes are influenced by the norms and values of socializers (Eagly & Chaiken, 1993). There is evidence that high-quality early childhood education is effective in developing young children’s attitudes and forming
their behaviors as well as in having positive effects on children’s well-being, health, and intellectual and social behavioral development, especially in terms of children from disadvantaged backgrounds (Muennig et al., 2011; Sylva, Melhuish, Sammons, Siraj-Blatchford, & Taggart, 2004).

Researchers continuously stress the importance of education for sustainability (EfS) being integrated into early childhood education (Cutter-Mackenzie & Edwards, 2013; Davis, 2015; Pramling Samuelsson, 2011; Siraj-Blatchford, 2009). The fundamental concepts for EfS are caring for oneself, for others and for the world (Johansson, 2009). Pramling Samuelsson (2011) suggests that instead of children being made scared of the catastrophes that are caused by adults, they can be given the opportunity to become creative individuals with the ability to face the unknown future. At the same time, it is important to remember that sustainability is everyone’s business; it does not rest only on the shoulders of young children or teachers (Davis, 2015; Pramling Samuelsson, 2011).

To create necessary changes for sustainability within early childhood education, it is important that all levels work together (Ferreira & Davis, 2015). In this regard, parents and teachers are particularly important. A few studies on the influence of parents’ attitudes and behavior on young children’s attitudes and behavior have been conducted (for example, Anders et al., 2012; Musser & Diamond, 1999; Webley & Nyhus, 2006), but studies exploring the influences of preschool- and home-related factors on children’s learning for sustainability are lacking.

Although research on early childhood education for sustainability is increasing, the field is still considered to be under-researched and ignored (Elliott & Davis, 2009); in particular, studies related to the social and economic dimensions of sustainability are scarce (Davis, 2009; Hedefalk, Almqvist, & Östman, 2015).

It has been argued that questioning the appropriate age for exploring sustainability issues with children simply reveals a ‘blind spot’ about the lives of children, who are already living in this daily complexity, and their ability to understand these issues (Davis, 2015; Elliott & Davis, 2009; Pramling Samuelsson, 2011). This blind spot supports beliefs that children are incapable of making sense of the world they live in. Therefore, it is important to explore the knowledge and practices of children in this regard to improve educational practices at the preschool level and to facilitate evidence-based policymaking.

**Sustainable development – a global concern**

Defined as “development that meets the needs of the present without compromising the ability of future generations to meet their needs”, the concept of sustainable development was introduced as a critical global issue
at the end of the 1980’s (Brundtland, 1987, p. 43). Since then, hundreds of different definitions of sustainable development have been proposed along with thousands of interpretations (Gibson, 2005). To simplify the comprehension of the concept, different frameworks have been suggested in which the three main aspects of sustainability – environmental or ecological, social, and economic – are intertwined (Elliott, 2013). The environmental dimension of sustainability includes, for example, natural resources, climate change, rural development, sustainable urbanization, and disaster prevention and mitigation. The social dimension of sustainability addresses human rights, peace and human security, gender equality, cultural diversity and intercultural understanding, health, and governance. Finally, the economic dimension of sustainability refers to, for example, poverty reduction, corporate responsibility and accountability, and the market economy (UNESCO, 2006). In addition to these three dimensions, cultural and ethical dimensions of sustainable development have been emphasized by Kemp (2005) and Johansson (2009), as human beings are part of a local community and are responsible for a common world. Since sustainability is concerned with policies and political decision-making, some researchers also argue for a political dimension to sustainable development (Fien, 2004; Ärlemalm-Hagsér, 2013). In my dissertation, the cultural, ethical and political dimensions of sustainability are considered to be integral parts of social sustainability.

The underlying issues of sustainability are complex, and the main area of complexity lies in the divergence between economic development and the natural environment (Fien & Tilbury, 2002). Caring for the Earth, a strategic plan for a sustainable future, states that “Living sustainably depends on a duty to seek harmony with other people and with nature. The guiding rules are that people must share with each other and care for the Earth” (IUCN, UNEP & WWF, 1991, p. 8).

In this study, sustainability concerns people’s relations with other human beings, animals and nature, and with the surrounding environment. The term ‘sustainability’ is used throughout the text with the exception of international declarations, where the original term ‘sustainable development’ has been used.

**Education for sustainable development**

Education plays a significant role in facilitating societal change and progressing sustainability in formal and informal education sectors (Bonnett, 2002; Stibbe, 2009). According to Durkheim, education is a ‘methodical socialization’ that begins at birth, within the family, and that continues at school, where teachers play vital roles in society’s transformation and changes (Lukes, 1972).
To promote sustainability within all areas of education and learning, the United Nations General Assembly declared the Decade of Education for Sustainable Development (DESD) (2005-2014) in December 2002 (UNESCO, 2005). EfS is intended to enable people to acquire the knowledge, attitudes, values and capacity necessary to promote a sustainable future (UNESCO, 2006). In other words, Efs can be seen as a link between the local and the global, the environmental and the socio-cultural, and the human and the non-human world (Wals, 2010). As claimed by Lang (2007, p. 6), EfS requires “a deep understanding of ourselves, our neighbors, our societal and cultural processes, and how we are connected with the ecological systems for life”.

DESD has ended, and a new plan of action has been outlined for “people, planet and prosperity” in the 2030 agenda for sustainable development (United Nations, 2015, p. 1). The plan sets 17 sustainable development goals (SDGs), which include quality education, lifelong learning for all, sustainable economic growth, sustainable consumption, reduction of inequality within and among countries, and the combating of climate change and its impact. The vision of this agenda is to create a world where people will live in harmony with nature and in which wildlife and other living species are safe and protected.

**Education about, in, and for sustainability**

Davis (2015) advocates for transformative education practices for sustainability that recognize children as active and capable individuals who can shape their future. In a transformative approach to EfS, children are encouraged both to learn about and in the environment, as well as to learn how to act for the environment and for sustainability. Education about the environment focuses on developing awareness, knowledge and understanding about the interaction between people and nature. Education in the environment gives direct experiences of environments and looks for developing positive feelings and attitudes about nature and natural elements (Davis, 1998), whereas education for the environment warrants knowledge about social and ecological processes with a commitment to act, and empathy towards people and nature. This dissertation uses the term education for sustainability, which originates from this three-fold approach in environmental education.

Although education for sustainability and environmental education are closely related to each other, different conceptions of sustainability, education and environment coexist (Sauvé, 1996). Regarding environmental education, Davis (1998) explains that it is about values, attitudes, ethics and actions involving children, teachers and communities that work together to resolve environmental issues and problems. However, environmental
education has tended to emphasize ‘green’ aspects regarding nature conservation and human relationships with the natural environment (Elliott & Davis, 2009).

The recent shift in terminology, from environmental education to education for sustainability, was introduced to balance the perceived ‘greenness’ of environmental education and to emphasize the pedagogies of humans as “agents of change” (Elliott & Davis, 2009, p. 67). In education for sustainability, children’s active participation and agency in early childhood educational practices are emphasized (Davis, 2009; Elliott & Davis, 2009; Hägglund & Pramling Samuelsson, 2009; Pramling Samuelsson & Kaga, 2008). The term ‘agency’ is commonly described as something that people achieve in different situations through their engagements, rather than something they possess (Bieta & Tedder, 2007).

Children observe, learn, experience and recognize complex issues that are going on around them (Doverborg & Pramling Samuelsson, 2000; Pramling Samuelsson, 2011). Not only is it childhood experiences in nature that contribute to creating pro-environmental attitudes and developing a sense of respect for the environment (Chawla & Cushing, 2007), but meaning-making is also closely related to children’s experiences from the surrounding environment (Sommer, Pramling Samuelsson, & Hundeide, 2010).

Since EfS is concerned with learning for sustainability rather than learning about sustainability, a school is supposed to incorporate teaching and learning for sustainability “not only through aspects of the curriculum, but also through sustainable school operations such as integrated governance, stakeholder and community involvement, long-term planning, and sustainability monitoring and evaluation” (Hargreaves, 2008, p. 69).

**Early childhood education for sustainability**

As defined by UNESCO (2017), early childhood refers to the period between birth and eight years of age. Early childhood is the most significant time for development and is often considered to be the foundation on which the life of a child is built (OECD, 2006). The term ‘early childhood education’ is related to – and sometimes interchangeable with – terms such as early childhood care, early childhood development, and early childhood education and care (UNESCO, 2002). The Jomtien Declaration of the World Conference on ‘Education for All’ states that learning begins at birth, which calls for early childhood care and initial education involving families, communities, or institutional programs (Myers, 2004). This study uses the term ‘early childhood education’ that focuses on children’s learning and care at preschools and at home.
Early childhood education for sustainability in Sweden

In Sweden, preschool refers to early childhood education and care for children until they start school, which normally is at age six or seven (Skolverket, 2017a). All children in Sweden are offered preschool education from the age of one, and they are entitled to receive three hours a day of free preschool education from the fall of the year they reach the age of three (Skolverket, 2017a). Commonly staffed by preschool teachers and child attendants, the preschool is viewed as a separate school form where teaching is conducted or supervised by preschool teachers. Pedagogical activities provide young children with the opportunity to learn through play, as well as through creating and exploring the world on their own, in groups and with support from adults.

As confirmation of the importance of preschool, the first National Curriculum for Preschool (Lpfö 98) came into force in 1998, and the preschool became part of the Swedish education system under the Swedish National Agency for Education (Persson, 2008). In the National Curriculum for Preschool, children are described as individuals with competencies and as active people who have experience, interests, knowledge and skills (Skolverket, 2011). Preschools in Sweden are expected to include educational activities highlighting nature and the environment, as well as to work with democratic values as a foundation for learning and social interactions (Skolverket, 2011). The National Curriculum for Preschool states that all preschools should make efforts to ensure that each child develops respect for all forms of life and cares for the surrounding environment (Skolverket, 2011).

Although the term sustainable development or sustainability is not explicitly used in the preschool curriculum, the environmental, social and economic dimensions of sustainability are included as goals to strive for (Engdahl & Ärlemalm-Hagsér, 2014). The National Agency for Education explains sustainability as shared responsibility and solidarity between generations, genders, communities and countries (Skolverket, 2016). EfS is an extension of the earlier environmental and social traditions, and aims to improve the quality of life of Swedish citizens (Engdahl & Ärlemalm-Hagsér, 2014). In Sweden, the focus moved from environmental education to education for sustainable development (ESD) in 2004, which reflected a change in emphasis and direction after the DESD was declared. To promote sustainability, Sweden now has “all the legal instruments necessary for environmental education and ESD” (Breiting & Wickenberg, 2010, p. 17). However, the question is whether this change has had any impact on educational practices (Lundegård, 2007).
Eco-certification of preschools in Sweden

To promote education for sustainability in all aspects of education and learning, the Swedish National Agency for Education offers preschools the certification ‘Diploma of Excellence in Sustainability’. To be certified requires compliance with a set of sustainability-related criteria, including systematic quality work of educational management, and educational work in accordance with laws and regulations relevant to EfS (SKOLFS, 2009:19). The criteria include the need for preschool personnel and children to work together to plan, implement, follow up and evaluate learning for sustainability. Children are expected to have an active role and a real influence on their learning. The diploma is renewable every three years if the preschool reapplies for it. Since 2014, the Swedish National Agency for Education has certified 248 preschools, which were about 2.5% of the total number of preschools, for their work with EfS as ‘Preschool for Sustainable Development’ (Skolverket, 2014a; 2014c).

Preschools can also apply for ‘Green Flag’ certification by the Keep Sweden Tidy Foundation, which is part of the eco-school program of the Foundation for Environmental Education. In Sweden, the ‘Green Flag’ certification has existed since 1996 and about 1,600 preschools are currently certified (Håll Sverige Rent, 2016). The Keep Sweden Tidy Foundation supports preschools in their systematic work with EfS for active and long-term sustainability. Participating preschools write action plans for their educational work, which are submitted to the foundation and evaluated periodically. The staff can also participate in in-service training on EfS to gain ideas about how to implement EfS at their preschools. Although this eco-school program is coordinated internationally, the member nations are free to design their programs according to their own needs (Henderson & Tilbury, 2004).

In this study, preschools with ‘Green Flag’ or ‘Preschool for Sustainable Development’ certification are categorized as ‘eco-certified’ preschools. Due to the profile of such preschools, some positive outcomes would be expected in terms of enrolled children’s knowledge of, attitudes towards and practices related to sustainability-related issues, particularly when compared with those of children in non-eco-certified preschools (Olsson, Gericke, & Chang Rundgren, 2015). There has been a general lack of research on and evaluations of the effectiveness of EfS programs in whole-school sustainability programs globally (Henderson & Tilbury, 2004). A whole-school approach to EfS emphasizes the need to integrate sustainability education throughout the formal sector curriculum in a holistic manner instead of teaching it as an isolated topic (Hargreaves, 2008; Henderson & Tilbury, 2004).
According to the Education 2030 Framework for Action, the effect of education policies should be evaluated by all countries at a national level, and policies “must build on monitoring results and research findings to ensure effective evidence-based decisions and results-oriented programs” (UNESCO, 2016, p. 31). Although Sweden is considered to be a world leader in taking initiatives for promoting EfS, empirical research on EfS within preschool education is limited (Breting & Wickenberg, 2010; Ärlemalm-Hagsér & Engdahl, 2015).

Despite different certifications being granted in Sweden since 1998, very little is known about the effect of eco-certification in terms of children’s knowledge and practices of sustainability, and what types of educational activities are instrumental to helping develop children’s knowledge and practices of sustainability-related issues. To contribute to addressing this research gap in a Swedish context, this study was undertaken.

**Aim and objectives**

With an overall aim of enhancing the knowledge about preschool children’s learning for sustainability in Sweden, the objectives of this study have been:

- to investigate and compare the knowledge and self-reported practices of sustainability among children who attend eco-certified and non-eco-certified preschools, respectively,
- to explore the extent to which preschool- and home-related factors are associated with children’s knowledge and practices of sustainability, and
- to explore children’s perceived sources of such knowledge.

**Terminology**

Before presenting the research questions, brief descriptions of the terms ‘knowledge’, ‘self-reported practices’ and ‘perceived sources of knowledge’ are provided below to help readers understand what is meant by those terms in this dissertation.

It is challenging to define the term ‘knowledge’ because ‘knowledge’ is often associated with the notion of truth (von Glasersfeld, 1990). In the Swedish National Curriculum for Preschool, knowledge is defined as a complex concept that can be described as “facts, understanding, skills, familiarity and experience – all of which presuppose and interact with each other” (Skolverket, 2011, p. 8). Further, young children are seen to develop their knowledge through, for example, play, interaction, observation and discussion (Skolverket, 2011). This study does not intend to define the term ‘knowledge’; rather, the term is used to refer to the descriptions of children’s self-reported knowing through their responses (verbal and by action).

Further, knowledge can be declarative or functional in nature. ‘Declarative knowledge’ refers to children’s descriptions of different topics based on their
expressions in words, writing or drawing, while ‘functional knowledge’ refers to what children actually show they can do or perform (Biggs & Tang, 2011; Hattie & Yates, 2013; Hook, Wall, & Manger, 2015).

‘Self-reported practices’ refers to children’s own descriptions of what they do and how they carry out different activities at preschools and at home or when they are with friends. Similarly, ‘perceived sources of knowledge’ refers to their own descriptions of where they have learned about concerned issues. Self-reported descriptions of practices and sources of knowledge may differ from actual practices or sources.

**Research questions**

This study and its research questions have been addressed in four different papers. Papers I-III explore particular aspects of children’s knowledge, practices and sources of knowledge of sustainability, whereas paper IV investigates their relation to various preschool- and home-related factors. These factors are illustrated in figure 1.

![Figure 1. Overview of the preschool- and home-related factors considered in this study.](image-url)
The research questions are presented paper-wise below.

**Paper I: Economic equality**
- What do preschool children in Sweden know about the economic situation of other children in the world?
- How do preschool children view other children’s economic ability to buy new toys from a shop?
- What are preschool children’s perceived sources of knowledge on this issue?

**Paper II: Resource sharing**
- How do preschool children like to use money that they receive?
- To what extent are preschool children willing to share resources, such as candies, with friends?
- How do preschool children justify their choices when it comes to the use of money and the sharing of resources with others?
- What are preschool children’s perceived sources of knowledge when it comes to sharing resources with others?

**Paper III: Transport use**
- How do preschool children describe the word ‘environment’?
- What do preschool children know about the impact of cars, buses, bicycles and walking on the environment and living beings?
- What are preschool children’s perceived sources of knowledge on the environmental impact of different transport modes?
- Is there any relationship between children’s knowledge about the environmental impact of various transport modes and the type of preschool they attend?

**Paper IV: Economic equality, resource sharing, recycling and transport use**
- What is the relative importance of the factors (preschool and home) measured in this study for explaining children’s declarative knowledge of sustainability issues?
- Which effective practices at preschool and home can promote children’s functional knowledge of sustainability issues?
- What differences can be found between eco-certified and non-eco-certified preschools with regards to educational practices, as measured in this study?
Earlier research

This chapter describes earlier research of relevance to the objectives of my study. Earlier studies were searched for in databases, books and reference lists of relevant articles, and, in addition, personal contacts were made to learn about related studies.

Searches were performed in ten databases: Academic Search Elite, DiVa, EconLit, ERIC, Google Scholar, GreenFILE, Scopus, SwePub, Web of Science and Women’s Studies International. The databases were selected according to their coverage of educational research related to environmental and sustainability issues. It was necessary to combine two groups of search terms to achieve the purpose. The first group of search terms concerned preschool settings while the second group concerned sustainability. The search terms in the first group included: nurser*, daycare cent*, day-care cent*, early childhood education, preschool*, pre-school*, kindergarten* and forest school*. The search terms in the second group included: sustainable development, sustainability, environmental education and outdoor education.²

The intention of this chapter is not to report a literature review, but to present findings and experiences of relevance to my study from studies conducted at preschools addressing environmental or sustainability education. They are presented under the headings: Children’s knowledge and practices of sustainability, Eco-preschools and education for sustainability, and Influences of teachers and guardians on children’s learning for sustainability.

Children’s knowledge and practices of sustainability

Existing research about preschool children’s knowledge and practices of sustainability shows that in general children know about environmental and sustainability issues; that they have ideas about what to do; and that they are able to create meaning about the relationship between human behavior and the environment. Although different methods have been used to collect data from children, most studies employed individual interviews with children using illustrations and photographs to explore their knowledge, awareness, understanding, thoughts and views (for example, Cohen & Horm-Wingerd, 1993; Ergazaki & Andriotou, 2010; Palmer, 1993; 1994; 1995; Palmer et al., 1996; Palmer et al., 1999; Palmer et al., 2003; Palmer & Suggate, 2004). This

1 * = Any letter. For example: ‘cent*’ includes center, centre, centers and centres.
2 All databases were not searched at the same time using all search terms. The searches generated a total of 6,980 hits, which were exported to EndNote for scrutiny. A total of 120 articles were considered relevant to my field of study. For more information on the review method, see Borg (2015). Other texts, such as book chapters and articles received from other sources, are not included in this number.
indicates that young children are capable of sharing their ideas, thoughts and views about environmental and sustainability-related issues. These methodological experiences support the feasibility of my choice of collecting data directly from children.

A majority of the included studies were carried out on environmental sustainability, and many of them were conducted more than 20 years ago just after the concept of sustainability had been introduced. Although research in the field of ECEfS is on the rise, the number of studies related to social and economic dimensions of sustainability is still limited (Davis, 2009). It has been argued that all three dimensions of sustainability are needed to be treated as an integral part; otherwise, any sustainability-related practices and policies are likely to fail (Siraj-Blatchford, Smith, & Pramling Samuelsson, 2010). Therefore, my study was designed to address all three dimensions of sustainability.

A series of articles have reported findings from an international research project entitled ‘Emergent Environmentalism’, which concerned children’s knowledge about and awareness of four environmental issues: national, global warming; tropical rainforests; deforestation/endangered species; and management of waste materials (Palmer, 1993; 1994; 1995; Palmer et al., 1996; Palmer et al., 1999; Palmer et al., 2003; Palmer & Suggate, 2004). Children aged four to seven years from England, USA, Greece and Slovenia were interviewed individually using a series of photographs. The results showed that a large majority (90%) of the children could elaborate on the basic idea of global warming related to what would happen if the weather changed at the North Pole and it became warmer: for example, children thought that if snow were to disappear, then it would go to Santa Claus’ house, and that it is Santa Claus who makes snow (Palmer, 1993). Although all children could elaborate on what we should do with the waste, only a few (8%) of them knew the meaning of recycling (Palmer, 1994). Both the four- and six-year-old children had more accurate knowledge about polar inhabitants than rainforest inhabitants (Palmer et al., 1999).

A study in Greece reported preschool children’s ecological interpretations of human actions upon plants or animals (Ergazaki & Andriotou, 2010). Data were collected from 70 preschool children aged four and five years using semi-structured interviews and a series of pictures. All informants pointed out the direct threat that a forest fire poses on the lives of animals. Some of them recognized ‘long-term/ecological’ consequences for the animals as a result of a forest fire, including the destruction of habitat – i.e., they have to leave the forest.

Likewise, ecological awareness was examined among 88 children aged three to five years in USA using simple line drawings (Cohen & Horm-Wingerd, 1993). Results showed that the children were capable of identifying graphically depicted ecological issues with accuracy depending on the nature
of the task and its level of difficulty. The children demonstrated evidence of consistent judgments about the effects of pollution, trash and natural resource management. The findings did not indicate any differences between girls and boys, or urban and rural residency in performance on the measures of ecological awareness.

Some of the studies used a questionnaire to explore preschool children’s environmental attitudes and the level of their environmental knowledge (Grodzieska-Jurczak, Stepska, Nieszporek, & Bryda, 2006). For example, a study was conducted in 30 preschools in Poland, and to collect data from 674 children (aged six), a questionnaire was used that showed ten pairs of drawings. The questionnaire was developed in accordance with the American scale Children’s Attitudes Towards the Environmental Scale-Preschool Version (CATES-PV) (Musser & Diamond, 1999). The findings demonstrated that almost all (95%) of the participating children cared about keeping their environment clean, and that some (30%) of them sorted waste at home. Children from rural settings reported a stronger environmental stance more frequently than did those from towns. Thus, in studies of sustainability among preschool children, it is important to account for possible location-based variations, something that I considered in my selection of preschools for my study. In my study, preschools were selected that were located in towns, small cities, and one large city so as to explore whether location has any role to play when it comes to children’s knowledge and practices of sustainability.

Preschool children’s ideas about sustainability in terms of environmental, social-cultural and economic aspects based on the 7Rs (reduce, reuse, respect, rethink, reflect, recycle and redistribute) have been explored in Turkey (Kahriman-Öztürk, Olgan, & Güler, 2012). The study also inquired whether gender had any influence on children’s ideas about sustainability. Semi-structured interviews were conducted using a pictorial questionnaire called Preschool Children’s Attitudes Towards Environmental Issues, and one-on-one interviews were audio-recorded. Thirty-six preschool children aged five and six years from four different public preschools participated. Regarding the environmental aspect, nearly two thirds (63.9%) of the children mentioned ideas about reducing water, paper and electricity consumption as ways to save the environment. In terms of the social and cultural aspects, two thirds (66.7%) of children spoke about respecting animals, plants, nature and people, even though they did not seem to have many ideas about ‘rethink’ and ‘reflect’. Concerning the economic aspects of sustainability, one in four (25.0%) children considered recycling as a way to save nature, but none mentioned the redistribution of materials. Gender did not seem to have any influence on preschool children’s ideas about sustainability.
Two articles (Gulay, Yilmaz, Gullac, & Onder, 2010; Gülay Ogelman, 2012) report the findings of a project entitled “Learning about Soil with Tipitop and His Friends” in Turkey. It introduced soil and concepts related to soil conservation to preschool children who were five to six years old. An experimental method with experimental and control groups was used to investigate the effect of soil education on children. A total of 180 preschool children (90 children in each group) participated in the project. Findings showed that soil-related knowledge scores of children increased statistically significantly in the experimental group of the project in comparison to those in the control groups. The study showed that children improved in terms of their awareness and knowledge about the environment.

Another study (Kabadayi, 2012) in Turkey found that after four weeks of training on eco-systems, ecology, recycling and environment, 60 preschool children from four preschool education institutions had learned about recycling and about disposing the components of hazardous elements that were threats to ecological systems and human life. They collected 320 dead batteries. The environmental training had a positive impact on the children, and they became strict environmental wardens.

An international study conducted in 28 countries examined children’s thoughts, comments and understanding of a picture showing the globe: a total of 9,142 children aged two to eight years took part in the study (Engdahl & Rabusicova, 2011). The results indicated that young children had knowledge about environmental issues, had ideas about what to do, and were able to create meaning about the relationship between human behavior and the environment. However, the reports from most of the countries mentioned that children did not recognize the concept of sustainability. In some countries, the term sustainable development did not exist or was not possible to translate into the native language. Thus, it is important in a study among children to be prepared to probe their understanding of key concepts.

This overview demonstrates that although there are a number of studies on children’s knowledge, views and attitudes towards environmental sustainability, very few studies on social and economic sustainability have been published. Moreover, the studies do not offer much insight into children’s behaviors and practices at home or at preschool on these issues. Therefore, my study was designed to investigate children’s self-reported knowledge and practices in terms of all dimensions of sustainability.

**Eco-preschools and education for sustainability**

Eco-preschools work with a whole-school approach to EfS, which emphasizes the need to integrate EfS throughout the formal sector curriculum in a holistic manner instead of teaching it as an isolated topic (Hargreaves, 2008; Henderson & Tilbury, 2004). The impact of EfS in a
whole-school approach program has been investigated in studies that involve children, teachers, management, parents and the community through case studies.

A main starting point in EfS is building on children’s participation, and viewing them as active agents and stakeholders for the future (Gothenburg Environmental Centre, 2010). Studies under the approach of education for sustainability focus on ‘action for change’ by involving children in different activities (Davis, 1998 p. 119). Although there is an increase in integrating EfS in the pedagogical work of preschools in Sweden, Ärlemalm-Hagsér’s (2013) opines that all teachers do not fully acknowledge the view of children as active citizens who are capable of being involved in activities to bring about change in society.

Some case studies have reported the impact of EfS in eco-preschools involving children, teachers, management, parents and the community (Chan, Choy, & Lee, 2009; Davis, 1998; Davis, 2005; Lewis & Baudains, 2007; Lewis, Mansfield, & Baudains, 2010; Mackey, 2012). In general, the results demonstrate that children, together with adults and their teachers, could take part in various environmental and social activities and could participate in decision-making to find solutions to environmental problems. As eco-certified preschools work explicitly with EfS, such impact on children’s knowledge and behaviors are expected. Although some qualitative studies have analyzed the impact of eco-schools in whole-school programs, rarely have any quantitative studies been conducted to compare the outcomes of eco-certified preschools in relation to non-eco-certified preschools. To enhance our knowledge about EfS at preschool, my study has investigated whether there are any differences between eco-certified and non-eco-certified preschools in terms of children’s knowledge and practices of sustainability applying both content analysis and multivariate analysis.

A case study in Australia (Davis, 2005) reported how a kindergarten incorporated sustainability into its day-to-day curriculum practices in a process of slowly evolving changes. Ethnographic inquiry, which developed as a result of an eight-year professional relationship between two researchers with the center, was utilized. The study participants were children aged two and a half to around six years. Approximately 63 children were cared for each day, and 79 children across three age groups attended weekly. After being involved in a water conservation project, the children increased their knowledge about water issues, and their inquiries led to water conservation actions. Children’s involvement in the water conservation project also led to less water consumption, and their water conservation habits transferred to their families at home. The results indicated that young children, with the support and guidance of teachers, were capable of being engaged in EfS. The children demonstrated their active participation in social issues through a shopping trolley project, which focused on morality. They showed their
concerns about the morality of stealing shopping trolleys and expressed their thoughts in a letter to “the burglars”. As they did not know the addresses of the burglars, they decided to send the letter to the local newspaper to inform community members. The children were found to act both as decision-makers and as social and environmental activists. The various pedagogical activities of the kindergarten led to improved resource use and waste management, reduction in paper usage, a less environmentally harmful kitchen and less water consumption, which reduced the center’s ‘environmental footprint’.

Lewis, Mansfield and Baudains (2010) have reported attitude, understanding and behavior outcomes among early childhood students who had been engaged in an EfS program in a whole-school population in Australia. Thirty-six early childhood students participated, which included 15 pre-primary and 21 lower-primary students. Using a phenomenological approach, data were collected from students by using questionnaires. Children were engaged in three EfS projects, namely, biological survey, reed planting and turtle nest-watch in the local contexts. Findings from the three EfS projects showed that pre-primary school children recognized the importance of preserving native habitats and got involved in planting native flora to improve local habitats. They tested the water quality of the local lake and were left concerned by how poor it was; consequently, they planted native reeds, which improved the quality of the water. Children, together with other staff and community members, got actively involved in a turtle nest-watch project to create a suitable nesting site for the turtles in order to protect them from road deaths. Children’s participation in the EfS projects demonstrated that they were able to share their knowledge, to express their attitudes towards local environmental issues and to describe their actions to improve the local environment.

Mackey (2012) reported a participatory case study in an enviroschool where teachers’ work focused on empowering young people to explore ideas, make decisions and take action within their community in New Zealand. Thirty children aged three to four years, three teachers, three parents and one kindergarten manager were involved over a period of six weeks. The data collection process involved a series of activities, such as observations, conversations with children and teachers on a digital recorder, interviews with adults, and focus groups with teachers and parents. By participating in the conversation around local and global issues, children became more aware of issues that have an impact on them and others, and they took part in discussions in the kindergarten setting and at the dinner table at home. Children demonstrated their ability to care about the environment and to work with a democratic process. The children looked for appropriate ways to respond to environmental issues.
A Swedish study concerning teachers’ understanding of and work with EfS was conducted in 187 preschools and the data were gathered through the use of a questionnaire. The results showed that EfS was mainly associated with environmental issues, such as nature experiences, recycling and reuse of resources (Ärlemalm-Hagsér & Sundberg, 2016). The economic and social dimensions of sustainability were largely missing. The study also showed that eco-certified preschools work more actively with environmental and sustainability issues with children than do non-eco-certified preschools. The results of earlier studies have also indicated that the relational aspects of environmental, social and economic dimensions have been considered unclear and problematic within the pedagogical activities of preschools (Hedefalk et al., 2015; Kultti, Larsson, Ärlemalm-Hagsér, & Pramling Samuelsson, 2016).

The above findings from case studies indicate that a whole school approach to EfS may have positive influences, not only to promote children’s learning for sustainability, but also to improve the quality of overall pedagogical activities. As the eco-preschools work explicitly with EfS, these outcomes are to be expected. However, we do not know the outcomes of non-eco-certified preschools in terms of children’s learning for sustainability in comparison with eco-certified preschools. This knowledge is important, particularly in a country like Sweden where environmental and sustainability issues are integral parts of the Swedish National Curriculum for Preschool (Lpfö98, Rev. 2010) (Skolverket, 2011). Therefore, my study has compared eco-certified and non-eco-certified preschools in terms of children’s knowledge and practices of sustainability.

**Influences of teachers and guardians on children’s learning for sustainability**

As social learning is considered to be important for the development of a sustainable world (Wals, 2007), knowledge about the influences of different socially mediated sources of information on young children’s learning for sustainability can be of great use in the development of effective strategies that ensure quality education. As children do not always have first-hand personal experiences of people, lives and society, they depend on indirect and socially mediated sources of information, such as parents, teachers, friends, siblings and TV (Barrett & Buchanan-Barrow, 2005). There are some studies that have explored the influence of parents’ attitudes and behaviors on children’s attitudes and practices in terms of environmental issues. The results indicated a positive relationship between child and parent attitudes and behaviors (Grodzieska-Jurczak et al., 2006; Musser & Diamond, 1999). However, the number of studies on these issues is limited, and no study that explores teachers’ and parents’ influences on children’s
knowledge and practices related to all three dimensions of sustainability was identified in this review. This knowledge is important in order to improve practices related to EfS. Therefore, one of the purposes of my study was to explore the influences of preschool- and home-related factors on children’s knowledge and practices concerning all dimensions of sustainability.

Musser and Diamond (1999) measured environmental attitudes of children and the pattern of relationships between child and parent using the CATES-PV scale. The scale was administered to 42 preschool children aged three to six years, and 64 parents completed questionnaires. Children’s attitudes were not found to be correlated with verbal communications with their parents; rather, they were linked with the extent to which the children participated in environmentally related activities at home.

Another study (Grodzieska-Jurczak et al., 2006) was conducted in Poland with 686 parents using a questionnaire that was developed following the CATES-PV scale (Musser & Diamond, 1999). In this study, data were collected from 674 six-year-old children using a questionnaire with 10 pairs of drawings in 30 preschools. The study was carried out to explain children’s attitudes through socio-demographic characteristics, and the attitudes and awareness of their parents. Nearly all (95%) of the children declared that they saved water by turning the tap off while brushing their teeth on a daily basis. A majority of parents also claimed to save water and energy, which may suggest the influence of parents’ behavior on the children’s attitudes. In addition, the study investigated children’s attitudes towards transport, reporting that 41% of the participating children traveled more frequently by car with their parents than by bus or bicycle. In the same study, a survey on parents’ knowledge and attitudes showed that 44% of them seldom chose public transport over their own modes of transport, and that 39% of them were seldom involved in local environmental actions. This indicates that the attitudes of the parents towards their choice of transport reflected in the children’s use of transport.

Besides the influence of parents on young children’s learning, teachers also play an important role. They can contribute to developing children’s knowledge about the ecological circle, and their awareness has been found to have a direct impact on children’s learning (Pramling Samuelsson, 2011; Pramling Samuelsson & Asplund Carlsson, 2008). For example, one study examined the importance of EfS in early childhood curriculum with particular reference to its inclusion in “Te Whariki”, the national early childhood curriculum in New Zealand (Prince, 2010). Sixty children aged between two and five, twelve staff, and parents from one kindergarten and one childcare center took part in the study. A case study approach was employed and participatory action research was conducted, and the data were collected using semi-structured interviews and field notes. Results showed that through the implementation of the integrated curriculum,
children began to understand the concept of living in a sustainable way. Most children stated how they had learned about environmental and sustainability issues from their mother, as well as from other family members, such as their father or uncles. Children frequently reported their sources of knowledge as being themselves.

Children’s own perceptions of their knowledge sources have been reported in a series of articles, which demonstrates that four-year-olds learn a great deal from their parents, family and TV, as well as through their own direct experiences, whereas six-year-olds learn from watching TV and reading books (Palmer et al., 1996; Palmer et al., 2003). The sources of children’s knowledge in Poland and the UK were difficult to trace, even though some children mentioned that they just learned things by themselves or that they had got to know about different things from their families (Palmer et al., 2003).

The findings presented above indicate that parents play an important role in developing children’s behaviors and attitudes (Anders et al., 2012; Musser & Diamond, 1999; Webley & Nyhus, 2006). Similarly, a longitudinal study in England found that the quality of learning at home is very important for developing children’s intellectual and social skills, and parental involvement at home with young children is more important than who the parents are or what their income levels are (Sylva et al., 2004). However, little has been done to explore the influences of teachers and parents on children’s learning for sustainability. This knowledge is fundamental to developing appropriate strategies to address early childhood education for sustainability, as well as to ensuring quality education for the younger generation. The lack of previous research exploring the influences of teachers and parents on children’s learning for sustainability gave me reason to include such aspects in my study. Previous studies have indicated instrumental sources of children’s knowledge, which led me to investigate children’s self-reported sources of knowledge for all dimensions of sustainability.
Theoretical and conceptual framework

This chapter presents a description of the theoretical and conceptual framework that was used at various stages in my study. Early childhood education for sustainability (ECEfS) is a combination of the two fields early childhood education and education for sustainability (EfS). There are many scientific theories that are used in the field of ECEfS – for example, systems theories, developmental theories, and learning theories – as they play different roles in different studies. To describe the meaning and the use of theories in research and practice, Eraut (2003, p. 63) points out that “theories have a strong influence on how we interpret and understand the world around us”. He (Eraut, 2003) argues that the meanings of theories are reconstructed based on the context(s) in which they are acquired as well as the context(s) in which they are utilized (Eraut, 2003). In different stages of my study, suitable theories were identified to frame the research questions, to select participants, to identify appropriate methods for collecting and analyzing data, and to interpret results.

Constructivism and pragmatism

The philosophical stance that lies behind my choice of methods and that provides the context for the process of my study draws from both constructivist and pragmatist assumptions. Constructivism is frequently connected to the understanding of phenomena shaped through participants and their subjective views, which can be, as is the case in my study, preschool children’s descriptions of their knowledge and practices in terms of different sustainability themes as active and competent participants. Pragmatism focuses on “what works”, and draws on several ideas using different approaches and valuing both objective and subjective knowledge, which is claimed to be associated with mixed methods research (Creswell & Clark, 2007). The pragmatist assumptions can be found in my study, specifically when comparing the eco-certified and non-eco-certified preschools in terms of children’s knowledge and practices. As mentioned in the Introduction chapter, this comparison was made to enhance our knowledge about the effect of eco-certification in terms of children’s knowledge and practices of sustainability, and what types of educational activities are instrumental to helping develop children’s knowledge and practices of sustainability-related issues.

Children as active and competent participants

Drawing on constructivist and pragmatist assumptions as discussed above, my study has been designed based on the “child perspectives” that are
created by adults to understand and reconstruct children’s perceptions and actions in the world as realistically as possible (Sommer et al., 2010). “Child perspectives” provide the opportunity to explore “children’s perspectives” about issues that concern their lives. In “children’s perspectives”, the child is viewed as the subject and the focus is on children’s own “expressions and presentation of their perceptions, experiences and feelings” (Sommer et al., 2010, p. 22-23). These perspectives are also consistent with the United Nations Convention on the Rights of the Child, which declares that all children have the right to express their views on all matters of concern to them (Article 13) and to gain knowledge about the world they live in (Article 29) (UNICEF, 1989).

Influenced by the Convention, the Swedish National Curriculum for Preschool (Skolverket, 2011) describes young children as active and competent citizens who have the right to influence issues that relate to their lives. Regarding children’s participation in studies, researchers argue that young children’s voices need to be heard and respected (Kyronlampi-Kylmanen & Maatta, 2011; Mackey & Vaealiki, 2011). The reason is that “giving children a voice will also empower them to greater levels of participation and involve them as young citizens” (Lloyd-Smith & Tarr, 2000, p. 70). In addition, children’s perspectives are also of special interest within EfS, which emphasizes the need to consider children as agents of change (Davis, 2009; Docherty & Sandelowski, 1999; Hägglund & Johansson, 2014).

In my study, child’s perspectives were utilized to frame research questions for children, to select data collection methods, to develop interview instruments, and to discuss results and methods. For example, individual interviews as well as observations were conducted as methods to collect data from children - instead of children being simply observed. In order to create the opportunity for children to participate in the study, the themes were operationalized, the instrument was developed with illustrations, and play-based activities were included considering that play is a natural component of children’s lives (Pramling Samuelsson & Asplund Carlsson, 2008; Pramling Samuelsson & Pramling, 2013).

**Social role models and children’s learning**

In the field of EfS, the importance of social learning for a sustainable society has been emphasized by Wals and van der Leij (2007, p. 32). They argue that social learning is a powerful tool to create a sustainable future, because it is “a transitional and transformative process that can help create the systemic changes needed to meet the challenge of sustainability”. Therefore, to effectively address EfS in early childhood education, we need to know which people are likely to make impressions on children’s learning, as well as what
factors and practices may influence their learning for sustainability. In my study, the aspects of social learning were considered to be key, providing the foundation for designing the study as it deals with ECEfS.

With regards to social learning, Bandura (1977) claims that in society, children are surrounded by many influential role models: for example, parents and siblings within the family, teachers at school, friends within peer groups, and popular characters on TV. Likewise, Bandura (1977) and Corsaro, Molinari and Rosier (2002) also claim that children’s learning occurs through being explicitly taught by others, through direct observation, through participation in activities and through sharing information from books. Children may pay attention to some people and encode their behaviors, and then may imitate the behavior they have observed. According to Bandura (1977), due to the increase in TV, films and other visual media that provide symbolic modeling, the roles of parents, teachers and other traditional models may become less prominent in social learning. Nowadays, children are also exposed to various social media through computers and mobile phones; hence, we have limited knowledge about preschool children’s sources of knowledge of sustainability. This information is thought to be useful, particularly for policymakers, in the identification of appropriate strategies for the implementation of EfS.

Following Bandura’s (1977) social learning theory, where he includes the influences of different social role models on children’s learning, different groups of participants – i.e., children and their guardians and the teachers and directors of preschools – were selected for my study. Similarly, the research questions were framed and the data collection instuments were developed based on four themes connecting environmental, social and economic dimensions of sustainability (see Table 1) to investigate preschool- and home-related influences on children’s learning.

Concerning children’s learning at home and preschool, Dahlberg and Lenz Taguchi (1994) argue that early childhood education is a specific arena where children develop and learn things within a certain framework, which might be different than what takes place at home. With the knowledge that learning is a cognitive process that takes place in a social context (Bandura, 1986), the research questions included children’s self-reported sources of knowledge on each theme, since children are considered to be the best source of information about themselves. Bruner (1960) argues that the social environment and social interactions are two key elements for children’s learning. He (Bruner, 1960) views children as active participants in learning, and acknowledges that the involvement of adults and knowledgeable peers can make a great difference in their learning. With this in mind, my study explores guardians’ and teachers’ involvements with children in discussions and practices of sustainability. The social learning theory (Bandura, 1977) has also been used to discuss the results and methods of this study.
Sustainability

Sustainability is a complex and challenging concept. To simplify the comprehension of it, several models have been proposed in which the three main dimensions of sustainability – environmental, social and economic – are interconnected (Elliott, 2013). In all models, environmental sustainability relates to the responsibility of humans to care for nature and preserve the complexity of ecosystems (Fien & Tilbury, 2002). Social sustainability addresses social, cultural and political issues that affect the quality of people’s lives within and between nations, and promotes participation, emancipation, freedom, equity, solidarity and peace (Siraj-Blatchford et al., 2010). Finally, economic sustainability deals with concerns about reducing the direct environmental burden in terms of production, use, disposal and consumption of goods and services (Siraj-Blatchford et al., 2010). It has been argued that the main challenge of sustainability lies in the divergence between economic development and natural environment (Fien & Tilbury, 2002). Overall, sustainability is about shared responsibility and solidarity between generations, between men and women, and between ethnic groups and countries (Skolverket, 2014c).

Two commonly used models to illustrate sustainability are the concentric circles and the interlocking-circles (Elliott, 2013), see Figure 2.

**Figure 2.** The concentric circles model (left) and the three-interlocking-circles model (right) (Elliott, 2013).

In the concentric circles model, the economic and social aspects are portrayed as being embedded in a wider circle of the environment. The model depicts how unsustainable human activities can damage the functioning of natural systems and ultimately threaten human existence. The
model also illustrates the limitations of the sphere of the environment, and how all human activities depend on the limited boundaries of nature.

The three-interlocking-circles model illustrates how the environmental, social and economic dimensions are interconnected. The model supports a holistic understanding of the interconnections between the three circles. It considers sustainability by maximizing the goals across all three circles simultaneously, and promotes an understanding that maintaining sustainability over time requires trade-offs across the different circles (Elliott, 2013). With regard to this, Siraj-Blatchford and colleagues (2010) mention how all three aspects of sustainability should work together because practices and policies developed without each aspect being taken into account are likely to fail. This reflects a growing need to consider all dimensions of sustainability in any research. My study was therefore designed in line with the three-interlocking-circles model of sustainability, addressing its environmental, social and economic dimensions (Brundtland, 1987).

**Operationalization of sustainability**

With regard to operationalization of sustainability, it would have been possible to select a wide range of research themes because sustainability is concerned with human to human relations and the relations humans have with the surrounding environment. However, considering the age group of the participating children and the limited time available for my study, the research themes had to be limited.

Within the three-interlocking-circles model (Elliott, 2013), the concept of sustainability was operationalized into four themes: *economic equality*, *resource sharing*, *recycling* and *transport use*. The themes were selected based on their relevance to UNESCO (2006) definitions of environmental, social and economic dimensions of sustainable development, the 2030 sustainable development goals (United Nations, 2015), their appropriateness in relation to the Swedish National Curriculum for Preschool (Skolverket, 2011), their perceived relevance for children and their comprehensibility from the perspective of the child. All four themes are interconnected and, as indicated in Table 1, each represents more than one dimension of sustainability.
Table 1. The relationships between the four themes with the environmental, social and economic dimensions of sustainability as defined by UNESCO (2006).

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<tr>
<th>Dimensions of sustainability</th>
<th>Environmental</th>
<th>Social</th>
<th>Economic</th>
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<tr>
<td><strong>UNESCO definitions</strong></td>
<td>Natural resources</td>
<td>Human rights</td>
<td>Poverty reduction</td>
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<td></td>
<td>Climate change</td>
<td>Peace &amp; human security</td>
<td>Corporate responsibility</td>
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<td>Rural development</td>
<td>Gender equality</td>
<td>Accountability</td>
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<td>Sustainable urbanization</td>
<td>Cultural diversity &amp; intercultural understanding</td>
<td>Market economy</td>
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<td>Disaster mitigation</td>
<td>Health</td>
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<th>Research themes</th>
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<td><strong>Economic equality</strong></td>
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<td>Papers I &amp; IV</td>
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<tr>
<td><strong>Resource sharing</strong></td>
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<td>Papers II &amp; IV</td>
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<td><strong>Transport use</strong></td>
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<td>Papers III &amp; IV</td>
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<td><strong>Recycling</strong></td>
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The *economic equality* and *resource sharing* themes relate to both social and economic dimensions of sustainability. To operationalize *economic equality* and *resource sharing*, it was necessary to find out what economy means in the lives of preschool children. Regarding children’s understanding of economics, Webley (2005, p. 43) has suggested that “we should not only
be concerned with the cash economy, but also need to consider their understanding of swapping, doing chores, and gift-giving”. He (Webley, 2005) continues that children’s understanding of economics begins through their participating in and being taught about the economic world of adults.

This study uses “candies” and “toys” as examples of possessions along with cash in framing semi-structured interview instruments for children, see Figure 3, because “candies” and “toys” are considered to be the kinds of possessions that children frequently deal with in their daily lives, whether at home, at preschool or in the playground, and about which they often have decision-making rights (Näsman & von Gerber, 2002; Webley, 2005).

**Figure 3.** Operationalization of the economic equality and resource sharing themes for children.

Children sometimes view the possession of desired toys or clothes as an important aspect of individuals, which can work as a motivation in the selection of friends (Selman, 1980). They experience economic inequalities while using money to buy and sell things in a daily transactional situation, and they gradually learn that some things are more expensive than others – for example, a comic book may cost more than an ice cream (Bombi, 2002).

The economic equality and resource sharing themes are also about equity, sharing responsibility and solidarity, and these themes were utilized to explore children’s knowledge of other children’s economic situations in the world and how they would spend money if they had some. The Swedish
National Curriculum for Preschool (Lpfo98, Rev. 2010) states that the preschool “should strive to ensure that each child develops the ability to take account of and empathize with the situation of others” and to be willing to help others (Skolverket, 2011, p. 10).

Recycling was used to explore children’s knowledge and practices of recycling through their responses and being involved in recycling activities. Recycling relates primarily to the environmental dimension of sustainability and it is a way of dealing with natural resources. In addition to preserving nature by reusing or composting waste, recycling includes both an economic dimension of sustainability since it saves money and a social dimension in terms of human rights and health. It was assumed that young children have observed and may have participated in some kind of basic recycling activities at home or preschool. In this study, children’s knowledge of recycling was explored through play-based activities to create opportunities for them to demonstrate their practical knowledge about how they recycle different items; they were then asked open-ended questions, such as “why they recycle”, “what happens to the items after they have been recycled” and “sources of knowledge on recycling”.

Transport use relates directly to environmental and health-related issues as it contributes to increased air pollution and carbon dioxide emissions, and has significant consequences for natural resources, and human health and well-being (Chapman, 2007), but it also has a direct connection to economic issues of sustainability as it is dependent on natural resources. Children learn about different transport modes by interacting with family members, friends and peers, as well as by seeing what others do (Baslington, 2009). To operationalize the Transport use theme, it was assumed that young children, to some extent, have used different modes of transport. They may travel with their parents or with adults from home to preschool by car, bus, bicycle or foot. Their knowledge about the environmental impact of various modes of transport was explored with the concept of short-distance traveling. Pramling Samuelsson (2011) argues that environmental issues have always been an integral part of children’s lives in Swedish early childhood education and that these issues can therefore be used as a starting point for their learning.

**Modes of representation**

The task of simplifying a complex concept, such as sustainability, for preschool children is a challenge. To address this challenge, the themes were adapted appropriately for preschool children, guided by Bruner’s (1961) iconic (image-based) mode of representation. Bruner (1960) argues that a child of any age is capable of understanding complex information; even very young children are capable of learning any material if the instruction is
organized appropriately. According to him, children construct their knowledge by organizing and categorizing information through a coding system (Bruner, 1961). His *three modes of representation* includes *enactive* (action-based), *iconic* (image-based) and *symbolic* (language or symbol-based) modes of representations. Regarding children from the age of one to six, Bruner (1966) mentions that they construct knowledge by organizing and categorizing information through *iconic* (image-based) representation in which information is stored visually in the form of images and diagrams. Based on Bruner’s (1961) *iconic* modes of representation, illustrations were developed on each particular theme to start a conversation in a child-friendly environment.

**Children’s logical justifications**

This study uses Biggs and Collis’ (1982) the Structure of the Observed Learning Outcomes (SOLO) Taxonomy to analyze and interpret the content of children’s responses and their logical justifications for their arguments. The SOLO Taxonomy was developed in line with ‘constructive alignment’. ‘Constructive’ comes from constructivist theory where learners are regarded as constructors of their own knowledge, while ‘alignment’ is rooted in a principle of curriculum theory, which emphasizes that assessment tasks are to be aligned with what is intended to be learned (Biggs & Tang, 2011). The SOLO Taxonomy classifies “learning outcomes in terms of their complexity, enabling us to assess students’ work in terms of its quality not of how many bits of this and of that they got right” (Biggs, 2016).

The SOLO Taxonomy includes a comprehensive five-level hierarchical model, namely, *prestructural, unistructural, multistructural, relational* and *extended* levels, see Table 5. At the *prestructural* level, a student misses points or lacks understanding; at the *unistructural* level, a student has a simple idea or carries out a simple task; at the *multistructural* level, a student shows several ideas, but the relationships between them are missing; at the *relational* level, the ideas are linked or connected, and at the *extended abstract* level, a student has extended ideas, and can generalize or reflect or create a new understanding (Biggs & Collis, 1982). Outcomes at the *unistructural* and *multistructural* levels relate to Surface understanding or knowing, whereas outcomes at the last two levels, i.e., the *relational* and *extended* levels, are associated with a Deeper understanding of the whole (Hattie & Yates, 2013; Hook & Mills, 2012).

The SOLO Taxonomy is claimed to be applicable in measuring cognitive learning outcomes in different subject areas and in understanding students’ thinking (Biggs & Collis, 1982), and evidence from several studies supports this claim (Bodin & Winberg, 2012; Burnett, 1999; Chan, Tsui, Chan, & Hong, 2002; Van Rossum & Schenk, 1984; Winberg & Berg, 2007).
Although the SOLO Taxonomy was originally developed for assessing elementary and high-school students’ performance, Hook and Cassé (2013) have adapted it to assess the understanding of young children’s learning in early childhood education. In the adapted Taxonomy, the prestructural level shows ‘no idea’, the unistructural level demonstrates ‘one idea’, the multistructural level contains ‘many unrelated ideas’, the relational level portrays ‘linked and integrated ideas’, while the extended abstract level demonstrates ‘extended abstract ideas’. In personal communication, e-mails (February, 2016), Pam Hook stated that an indicator of a relational learning outcome for young children is when they explain ‘why’ by using ‘because’ or ‘so that’, and that ‘double because’ is used as an indicator of extended abstract understanding.
Methodology and methods

This chapter presents the methodology and methods of the study. Methodology refers to the overarching approach to a study, whereas methods refers to selected tools, processes or ways in which data are collected.

Overview of the papers

This dissertation consists of four papers, see page v, of which an overview of objectives, conceptual frameworks, participants, data collection and data analyses is given in Table 2. Papers I-III investigated children’s self-reported knowledge, practices and sources of knowledge in terms of economic equality, resource sharing and transport use, respectively. Paper IV explored the influences of preschool- and home-related factors and practices on children’s knowledge and practices in terms of all four themes: economic equality, resource sharing, recycling and transport use, and how eco-certified preschools differ from other preschools in their ability to promote the beneficial practices of children.

Table 2. Objectives, conceptual frameworks, participants, data collection and data analyses in the four papers of this thesis.

<table>
<thead>
<tr>
<th>Paper</th>
<th>Objective</th>
<th>Conceptual framework</th>
<th>Participants</th>
<th>Data collection</th>
<th>Data analyses</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>To investigate children’s knowledge and views of the economic situation of other children in the world, and their self-reported sources of such knowledge.</td>
<td>Bandura’s social learning theory, Bruner’s three modes of representation, child perspectives, three dimensions of sustainability, SOLO Taxonomy</td>
<td>Children</td>
<td>Semi-structured interview</td>
<td>Content analysis, SOLO Taxonomy</td>
</tr>
<tr>
<td>II</td>
<td>To explore the knowledge and self-reported behaviors of preschool children in terms of the use of money and sharing of resources.</td>
<td></td>
<td>Children</td>
<td>Semi-structured interview</td>
<td>Content analysis, SOLO Taxonomy</td>
</tr>
<tr>
<td>III</td>
<td>To explore children’s knowledge about the environmental impact of various transport modes, and whether eco-certification plays any role in this regard.</td>
<td></td>
<td>Children</td>
<td>Semi-structured interview</td>
<td>Content analysis, SOLO Taxonomy, OPLS, OPLS-DA</td>
</tr>
<tr>
<td>IV</td>
<td>To investigate the relative influences of home- and preschool-related practices and factors on children’s declarative and functional knowledge of sustainability, and the extent to which eco-certified preschool promotes beneficial practices.</td>
<td></td>
<td>Children, guardians, teachers, directors</td>
<td>Semi-structured interview, survey questionnaires</td>
<td>Content analysis, SOLO Taxonomy, OPLS, OPLS-DA</td>
</tr>
</tbody>
</table>

Papers I and II of this study were single authored, whereas papers III and IV were written by multiple authors. Authorships conformed to the
recommendations provided by the Vancouver protocol\(^3\). As first author of papers III and IV, I contributed in conceptualizing and designing the study, developing and pretesting the interview and survey instruments, collecting and transcribing all data, conducting content analysis, being part of the statistical analysis process, drafting and finalizing the manuscripts, and being the contact person for the editors of the journals. The second author, Dr. T. Mikael Winberg, and the third author, Professor Monika Vinterek, made substantial contributions to papers III and IV by being involved in most of the stages of the study and by revising the manuscripts critically for important intellectual content. The second author led the work with statistical analyses, and drafted related texts in the methods and results sections. The third author made substantial contributions to the conceptualization of the study and the development of the instruments.

**Study design**

Considering the purpose of this study, a mixed methods approach was deemed appropriate. Mixed methods research is defined as research that mixes, combines or integrates qualitative and quantitative data, techniques, concepts and language into a single study or a number of studies (Creswell & Clark, 2007; Johnson, Onwuegbuzie, & Turner, 2007; Leech & Onwuegbuzie, 2009). In my study, a mixed methods approach was used in different stages of its design, i.e., when developing research questions, when developing instruments, and when collecting and analyzing data.

To point out the advantages of using mixed methods, Creswell and Clark (2007) mention that there are weaknesses in both quantitative and qualitative approaches; for instance, in quantitative research, the voices of the participants are not directly heard and the researchers’ personal biases and interpretations are rarely discussed; on the other hand, qualitative research is often criticized as being deficient due to researchers’ personal interpretations and its poor generalizability because of the limited number of participants. The intention of this study was not only to combine the strengths of one approach to make up for the weaknesses of the other, but also to enhance our understanding of children’s knowledge and practices of sustainability and to explain significant factors.

A qualitative approach with the use of semi-structured interviews was applied to make it possible to collect data from preschool children, since young children in Sweden usually do not learn to read or write at preschool, and, therefore, selecting responses from predetermined response categories or a list of items might be difficult for them. Moreover, due to the nature of the topic, for example, exploring children’s knowledge and practices, of which we have no prior knowledge, predetermined responses were not

possible to formulate. It was assumed that children may need to be asked the same questions differently using different vocabulary, and, if required, using repetition. Thus, a qualitative approach using semi-structured interviews was considered to be appropriate to minimize the misjudging of children’s responses and justifications from their own logical points of view. To analyze the data, a qualitative content analysis was conducted. The data were later coded based on SOLO levels to be used for statistical analysis.

An overview of the mixed methods approach used in this study is presented in Figure 4.

**Figure 4.** Overview of the use of mixed methods in this study. The qualitative and quantitative approaches were applied in various stages.

A quantitative approach was applied to collect data from guardians and teachers on preschool- and home-related factors. The method of questionnaire survey was selected, as it is practical, affordable and less time-consuming. Moreover, it provides data that facilitate statistical analyses.
Interviews were conducted to collect data from directors on their views concerning sustainability-related work at preschools and preschools’ demographic information using both closed- and open-ended questions. This method enables the collection of both quantitative and qualitative data, and was possible to conduct as the number of participants was limited.

**Context of the study**

This study has been carried out in Sweden, a Northern European parliamentary democratic country with about 10 million people of whom two million are below the age of 18. The official language is Swedish. The country has been a member of the European Union since 1994 (Quick facts about Sweden, 2016).

Sweden was one of the first countries in the world to ratify the UN Convention on the Rights of the Child and the first country to prohibit all corporal punishment of children in 1979. Sweden was also one of the 178 countries that adopted the Agenda 21 action plan in 1992, in which education was emphasized as being an important part (Breiting & Wickenberg, 2010). In 2004, the focus moved from environmental education to education for sustainable development (ESD) reflecting a change in emphasis and direction after the Decade for Education for Sustainable Development (DESD) was declared (Breiting & Wickenberg, 2010). However, researchers questioned whether this change has had any impact on educational practices (Lundegård, 2007).

The first Preschool Act was passed in 1975. Introducing the concept of ‘preschool’, it included all previous forms of early childhood education and care. Preschools can be owned by municipalities or by other organizations, such as parent cooperatives, companies or non-profit organizations (Skolverket, 2017a). Regardless of ownership, the costs of the education services are borne by the municipality. Municipalities receive contributions from the state based on demographic data, and also allocate their own resources towards this (Skolverket, 2017a).

Sweden has a total of 290 municipalities with more than 9,800 preschools. In 2016, a total of 114,202 children, between five and six years old, were registered in preschools (Skolverket, 2017b). In 2015, 94.1% of all 5-year-old children in Sweden were enrolled. The average preschool group size was 16.7 children, with 5.2 children per yearly employee and 12.5 children per yearly preschool teacher (National Agency for Education, 2016).

The Swedish National Agency for Education has suggested that EfS should be conducted in a way that prepares students to actively participate in society and develop their ability to take personal responsibility for their actions (Skolverket, 2014c). Moreover, according to the Swedish National Agency for Education, EfS is characterized by a democratic way of working,
critical approaches, interdisciplinary collaboration, diversity of teaching methods, participation and influence.

Sample

This study used non-probability purposive sampling (Cohen, Manion, & Morrison, 2011) to include equal numbers of eco-certified and non-eco-certified preschools, and, if possible, equal numbers of children from each type of preschool. The reason for this sampling was that it would allow for comparison between eco-certified and non-eco-certified preschools, and would facilitate statistical analyses that could be used to examine relationships between children’s knowledge and practices with guardians’ and teachers’ discussions and practices of sustainability-related issues.

To be included in the study, the municipalities were supposed to have at least one preschool with eco-certification, and each preschool had to have at least three final-year children whose guardians had consented to their participation in this study. The preschools were selected from six municipalities in two counties in Sweden with the intention to achieve representation in terms of towns, small cities and large cities. Another intention was to identify preschools from nearby municipalities so as to minimize the environmental impact of traveling, costs and time. Although all municipalities agreed to cooperate, not all preschools accepted the invitation to participate in the study. As a result, it was not always possible to involve both eco-certified and non-eco-certified schools from the same municipalities.

At the beginning, six eco-certified and six non-eco-certified preschools were contacted by telephone. Each set of eco-certified and non-eco-certified preschools were selected as close as possible to minimize bias when it came to children’s demographic backgrounds, such as families’ educational, professional, economic and socio-cultural backgrounds. In the initial stage of the study, out of twelve preschools, ten accepted the invitations and two did not. One of the non-eco-certified preschools declined participation in the study due to its engagement in other projects, and one non-eco-certified preschool was excluded as no consent was received from parents.

Consequently, two new non-eco-certified preschools were contacted from the same municipalities that fulfilled the inclusion criteria and they agreed to participate in the study. Information about the number of final-year preschool children was collected in advance from the directors of preschools.

Four non-eco-certified preschools were located in towns (≤12,000 inhabitants), four eco-certified and two non-eco-certified preschools were located in small cities (>12,000 inhabitants), and two eco-certified preschools were located in a large city (>500,000 inhabitants). The reason for selecting preschools from three different locations or settings was to
explore whether location has any role to play when it comes to children’s knowledge and practices of sustainability.

The data for my study were collected from children, their guardians, teachers and directors of 12 preschools, see Table 3.

**Table 3.** Participating preschools, children, guardians, teachers and directors.

<table>
<thead>
<tr>
<th>Type of preschool</th>
<th>Eco-certified Preschool for Sustainable Development</th>
<th>Non-eco-certified</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preschools</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Children</td>
<td>17</td>
<td>21</td>
<td>15</td>
</tr>
<tr>
<td>Girls</td>
<td>12</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>Boys</td>
<td>5</td>
<td>10</td>
<td>9</td>
</tr>
<tr>
<td>Guardians</td>
<td>31</td>
<td>33</td>
<td>25</td>
</tr>
<tr>
<td>Women</td>
<td>17</td>
<td>17</td>
<td>14</td>
</tr>
<tr>
<td>Men</td>
<td>14</td>
<td>16</td>
<td>11</td>
</tr>
<tr>
<td>Teachers</td>
<td>22</td>
<td>21</td>
<td>31</td>
</tr>
<tr>
<td>Women</td>
<td>22</td>
<td>19</td>
<td>29</td>
</tr>
<tr>
<td>Men</td>
<td>0</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Directors</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Women</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Men</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

1. One director was responsible for both a Green Flag and a non-eco-certified preschool.

Information letters about this study were sent to a total of nine preschool directors (see Appendix A); as two preschools declined to participate in this study, the directors of those preschools are not included in Table 3. In this study, the term guardians is used due to the fact that some children might live at foster homes with their guardians instead of their biological parents. Regardless of whether the guardians are biological parents or not, they are referred to as mothers and fathers in my dissertation.

Information letters were also sent to guardians (n=146) who had children in the final year of preschool (see Appendix B). The reason for selecting final-year preschool children, aged five to six years, was to explore the level of their knowledge and practices of environmental and sustainability issues upon their completion of preschool. The information letter included a consent letter for each child’s participation in the study, two sets of questionnaires for mothers and fathers to complete separately, and a pre-paid envelope for the return of their consents and responses to my university address. The information letters were handed in to preschool teachers who worked at the unit where the child was admitted. The reason for collecting data from guardians separately was that it could provide information about
whether or not the guardians’ gender had any role to play on children’s knowledge and practices of sustainability.

A total of 53 children were included in the study. Children from eco-certified preschools were over-represented as 46.9% (38 out of 81) of the guardians of children at eco-certified preschools consented to their children’s participation, while only 23.1% (15 out of 65) of the guardians of children at non-eco-certified preschools consented. Either one or both guardians of each child participated in the survey. Only those guardians who consented to their child’s participation were included in my study in order to connect influences of home-related factors with children’s knowledge and practices.

In this study, the term teacher is used to address both qualified teachers (n=41) and child attendants (n=33). Teachers who had been employed at least six months at a participating preschool were eligible for the study. It was assumed that this duration would allow them to be familiar with the pedagogical practices at their respective preschool and could therefore respond to the survey questions. Teachers who only worked at units with children younger than three were excluded from participation as my study included final-year preschool children. A total of 109 questionnaires with information letters were sent to the teachers (see Appendix C), of which 76.8% (43 out of 56) in eco-certified preschools and 58.5% (31 out of 53) in non-certified preschools responded.

Data on participating preschools (n=12) were collected from directors (n=7) of all preschools.

Data collection

This section describes the development of the interview instrument for children, the questionnaires for guardians and teachers, and the semi-structured interview instrument for directors, as well as the data collection procedures. The instruments were thematically connected in order to explore potential associations between, on the one hand, home- and preschool-related factors and practices, and, on the other hand, children’s knowledge and practices of economic equality, resource sharing, recycling and transport use.

Prior to the development of instruments for the collection of data on preschool children’s self-reported knowledge, practices and sources of knowledge, the literature was consulted to identify if there were any instruments available for collecting data on environmental, social and economic dimensions of sustainability from children and their guardians, teachers and directors. Only one relevant study reporting the development of an instrument to measure environmental attitudes in preschool-age children (Musser & Diamond, 1999) was identified. As that study focused mainly on
measuring environmental attitudes, it included neither the social or economic dimensions of sustainability, nor children’s knowledge or practices, and therefore did not serve the purpose of my study. However, Musser and Diamond’s (1999) study contributed with ideas of developing the instruments for my study. A set of instruments to collect data from the participant groups of my study was designed, pre-tested and finalized (see Appendices D, E, F and G).

Table 4 shows how questions for children, guardians and teachers were thematically connected to strengthen the ability to collect meaningful data. The semi-structured interview instrument for directors is not included in the table as it was not directly connected to children’s knowledge and practices; rather, it provided demographic information about preschools and directors’ views on EfS.

The data were collected in Swedish, and most parts of the interviews were transcribed and then translated into English. The data collection from children, their guardians, teachers and directors took place between February and September 2015.

**Observation and interviews with children**

Interviews and observation were considered appropriate methods for the collection of data concerning children’s knowledge and practices as well as for observing their recycling correctness. The reasons are: first, the *nature of the topic*, which focuses on exploring the individual child’s knowledge, practices and sources of knowledge; second, the *limited vocabulary* of young children, which may result in the need for explanations of unknown or difficult words, at least for some children, for them to understand the meaning of the questions; third, the possibility these methods offer to create a *playful and safe environment*, where a child can talk and be involved in activities freely and confidently; and fourth, the opportunity those methods create for children to *give voice* on issues that concern their lives.

Although studies indicate that children are capable of making sense of the world they live in, this does not necessarily mean that they understand everything in the same way adults do (Pramling Samuelsson, 2011). That is why a semi-structured interview instrument with open- and closed-ended questions was developed for children; see the complete instrument in Appendix A. It is assumed that the open-ended questions may help the researcher to get an “inter-view” of children’s knowledge and practices in terms of sustainability (Kvale, 1996, p. 14).
Table 4. Thematic questions across participant groups.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Children</th>
<th>Guardians</th>
<th>Teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic equality</td>
<td>Can all children in the world afford to buy toys from a shop?</td>
<td>How often do you discuss the following with the child:</td>
<td>How often do you discuss the following with your preschool children:</td>
</tr>
<tr>
<td></td>
<td>Why do you think that all children [can/cannot] afford to buy toys from a shop?</td>
<td>• children who live in different countries?</td>
<td>• children who live in different countries?</td>
</tr>
<tr>
<td></td>
<td>From where have you got to know about children who live in other countries?</td>
<td>• money or economic issues?</td>
<td>• money or economic issues?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• buying of second-hand clothes, shoes or toys?</td>
<td>• buying of second-hand clothes, shoes or toys?</td>
</tr>
<tr>
<td>Resource sharing</td>
<td>If you had a bowl of candies and your friend came and wanted to have some candies from you, what would you do?</td>
<td>How often do you discuss the following with the child:</td>
<td>How often do you discuss the following with your preschool children:</td>
</tr>
<tr>
<td></td>
<td>Why would you [child’s response]?</td>
<td>• giving away or selling used clothes, shoes or toys?</td>
<td>• giving away or selling used clothes, shoes or toys?</td>
</tr>
<tr>
<td></td>
<td>From where have you learned to [share/not to share] with a friend?</td>
<td>• sharing things with other children?</td>
<td>• sharing things with other children?</td>
</tr>
<tr>
<td>Transport use</td>
<td>How good or bad is it for the environment to travel by [bus; car; walking; cycling] to preschool when someone lives close to the preschool? Why is it [child’s response of good or bad] for the environment to travel by [bus; car; walking; cycling]? From where have you learned about this?</td>
<td>How often do you discuss the following with the child:</td>
<td>How often do you discuss the following with your preschool children:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• traveling with others to work or preschool?</td>
<td>• traveling with others to work or preschool?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• environmental impact of various modes of traveling?</td>
<td>• environmental impact of various modes of traveling?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Does your household have a car?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>How often do you use public transport (bus or train)?</td>
<td></td>
</tr>
<tr>
<td>Recycling</td>
<td>Could you show me how I can recycle a banana peel, a cola can and a plastic bottle? Do you recycle at home? What do you recycle? [Multiple options¹] Do you recycle at preschool? What do you recycle? [Multiple options¹]</td>
<td>How often do you discuss the following with the child:</td>
<td>How often do you discuss the following with your preschool children:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• reusing various goods, e.g. paper, cardboard, bottles, cans?</td>
<td>• reusing various goods, e.g. paper, cardboard, bottles, cans?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• recycling second-hand goods?</td>
<td>• recycling second-hand goods?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>How often do you:</td>
<td>How often do you:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• recycle at home?</td>
<td>• visit a recycling station together with children?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• visit a recycling station together with the child?</td>
<td>• engage the child in recycling activities at preschool?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• engage the child in recycling activities at home?</td>
<td>Are there any recycling bins available where children can put things?</td>
</tr>
<tr>
<td></td>
<td></td>
<td>What are the items you recycle at home?</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>[Multiple options¹]</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Are there any recycling bins available where children can put things?</td>
<td></td>
</tr>
</tbody>
</table>

¹. Paper, cardboard, newspaper, books, pens, toys, lamps, batteries, metal, food, plastic bags, bottles, cans, clothes.
The instrument included questions about children’s background (sex, age, type of preschool), their knowledge, practices and sources of knowledge about economic equality, resources sharing, recycling and transport use. Following Bruner’s (1961) iconic modes of representation, a set of colored illustrations was developed focusing on each theme and these were used as artefacts during the interviews.

Considering the importance of play as a natural component of children’s lives and as a basis for making children interested in particular phenomena (Pramling Samuelsson & Asplund Carlsson, 2008), a cuddly puppet, some toys, and a special sitting mat with a picture of two puppies were used to initiate a friendly and informal conversation with the child. The cuddly puppet, which was named Kim, was used for asking questions in a friendly and playful way. Ten preschools provided a separate quiet room, which allowed me to prepare the setting in advance, see Figure 5.

Figure 5. A photo from the interview setting for children at preschool.

Prior to individual interviews, I spent some hours with children either at their preschools, or following them to outdoor activities so that we could get to know each other. However, I was not able to spend time in advance at two of the eco-certified preschools as they were situated in a municipality far
from where I live, and two of the non-eco-certified preschools did not allow me to be with the children except for when I conducted interviews.

Each child was interviewed individually, and when permitted by guardians and the children themselves, most of the interviews were audio-taped. Guardians of forty-nine children granted permission for audio-recording, whereas guardians of four children did not. The reason for audio-recording the interviews was to avoid note-taking during the conversation, and thereby allow me to focus on creating a friendly and uninterrupted environment where a child could talk and act freely. Four children were interviewed in the presence of their teachers as per their own wishes. The interviews on all four sustainability themes took 15 to 25 minutes. However, not all interviews were completed in one sitting. Sometimes the interviews were stopped, for example, when the child seemed to get tired, or wanted to play or do something else, or another curious child entered the room to see what the friend was doing. The unfinished interviews were completed at another time.

All interviews were conducted in Swedish, which is a second language for me. To ensure the quality of the data, most parts of the interviews were transcribed. The Swedish transcription was checked randomly against the recorded interviews by a researcher whose mother-tongue is Swedish. Consequently, the transcription was translated into English. The English translation was also checked by a person whose mother-tongue is English, and whose second language is Swedish, to ensure the quality of the work.

A description of the children’s interview instrument is presented below under the themes economic equality, resources sharing, recycling and transport use along with related illustrations.

**Economic equality**

The conversation with children started with play-based activities showing them two illustrations of a shop and a child playing with toys, see Figure 6.

![Figure 6](image)

**Figure 6.** Illustrations on *Economic equality* from the children’s interview instrument.
Children were told that Kim (cuddly puppet) is curious to know if all children in the world can afford to buy toys from a shop. If the child did not know the word ‘afford (ha råd)’, then the word was explained by saying ‘have money or don’t have money’. Based on their responses, children were asked why they think that all children [can/cannot/may not be able to] afford to buy toys from a shop. Children were also asked from where they have learned about other children in the world.

Resource sharing

To explore children’s knowledge and practices of the theme resource sharing, the children were shown the illustration in Figure 7 and were asked about what the children in the illustration were doing.

Figure 7. Illustration on Resource sharing from the children’s interview instrument.

Often the conversations began in a natural way, with talk about whether the child liked to eat candies or whether she/he got candies on “cozy Friday”. (In Sweden, people have ‘fredagsmys’, which can be translated as cozy Friday: it is when family members enjoy their Friday evening together often eating chips, candies, popcorn or something similar, while watching TV programs.)

The children were told that Kim would like to know what they would do with their money if they had some. Then they were asked what they would do if they had a bowl of candies and a friend came and wanted to have some of the candies. Following the children’s response, they were asked why they would [share or not share]? If the child said that she/he would share, then the question was asked how much she/he would like to share, which was scored on a four-point Likert-scale with the response options I would give all the candies=3, I would give about half of the candies=2, I would give a few or very few candies=1, and I would not give any candies=0. Finally, the child was asked about the sources of her/his knowledge.
Recycling

The theme *recycling* investigated children’s knowledge and practices through play-based recycling activities. To explore their recycling function correctness, children were asked if they would like to teach Kim how to perform recycling activities. They were given three items – a banana peel, a cola can and a plastic bottle – to recycle in various types of trash bins, which included composting, disposal of waste, and bottle recycling. Each trash bin was marked with an illustration, see illustrations in Figure 8.

![Sample illustrations on Recycling](image)

Figure 8. Sample illustrations on *Recycling* from the children’s interview instrument.

The recycling function correctness was scored on a four-point Likert scale with the response options *Recycled all items correctly*=3, *Recycled two items correctly and one item incorrectly*=2, *Recycled one item correctly and two items incorrectly*=1, *Recycled all items incorrectly*=0. Children were also asked about their involvement in recycling activities at preschool and at home, and what items they usually sort.

Transport use

Children’s knowledge and sources of knowledge about the impact of different transport modes were explored using four illustrations. However, children’s practices on this theme were not explored considering that preschool children rarely travel anywhere alone. They usually travel with guardians or
maybe with another adult. Therefore, it is unlikely that they choose the means of traveling. The conversation with children on the transport use theme started with showing illustrations, see Figure 9.

Figure 9. Illustrations on Transport use from the children’s interview instrument.

The children were told that “Kim is curious to know what the word environment means. She has heard the word but does not really understand what it means. Would you like to tell Kim what ‘environment’ means?” By asking this question, it was determined whether a child knew the word ‘environment (miljö)’ or not. If the word ‘environment’ appeared to be unknown to the child, then I added the word ‘nature (natur)’. If both words seemed to be unknown to the child, the subsequent questions were asked differently using examples of trees, flowers, birds, animals and people.

The children were asked, for instance, “How good is it [for environment/nature/trees, flowers, birds, animals or people] if someone who lives close to the preschool goes to preschool by [transport mode]?” with the four Likert-type response options ‘Very good=3’, ‘Good=2’, ‘Quite good=1’ and ‘Bad=0’. There was also an option with ‘Know=1’ and ‘Don’t know=0’. Each closed-ended question was followed by an open-ended
question: “Why is going by [transport mode] [response option selected by child] for the [environment] if someone lives close to the preschool?” Finally, the children were asked from where they had learned about this.

**Survey among guardians**

A survey was conducted among guardians of participating children. A letter with information about the study and a questionnaire, along with a pre-paid envelope, were sent to both guardians (mother and father) of a participating child through the teachers at the unit where the child was enrolled. Each guardian was asked to complete the survey questionnaire separately, which required 10 to 15 minutes.

The questionnaire for guardians consisted of two parts: demography, discussions and practice between guardian and children about economic equality, resource sharing, recycling and transport use, see Appendix E. The demographic information included guardians’ sex, age, profession, place of residence, and level of education. The questions about frequencies of discussions between guardians and children on four sustainability themes and guardians’ practices of different transport use and recycling activities at home are presented in Table 4. The questionnaire included items related to car ownership, frequency of traveling with public transport, frequency of sorting garbage at home, and frequency of children participating in sorting garbage at home, the number of garbage types sorted at home, and the frequency of visiting recycling stations with children. A five-point Likert scale was used with the response options Never=0, A few times each year=1, A few times each month=2, A few times each week=3, and Every day=4 for all frequency questions.

**Survey among preschool teachers**

A survey was conducted among teachers who worked at the unit where the participating children were enrolled. A letter with information about the study and a questionnaire were sent to the teachers along with a prepaid envelope. The survey questionnaire required 10 to 15 minutes to complete.

The questionnaire for teachers consisted of four parts: demography, sustainability-related values, environment-related practices, and sustainability-related discussions between teachers and children, see Appendix F. In this study, the demographic variables position (teacher or child attendant), sex, age, work experience, level of education, and training on EfS were included. In the value question, the importance teachers assign to EfS at preschool was addressed on a Likert scale ranging from Not at all important=1 to Very important=4. There was also an option with ‘Know=1’ and ‘Don’t know=0’. The questions concerning practices related to the frequency of sorting garbage at preschool, trash bin availability, frequency of
children participating in garbage sorting, the type of garbage and total
number of types sorted at preschool (up to nine different items), and the
frequency of visiting recycling stations with children. The questions that
were about frequencies of discussions between teachers and children on four
sustainability themes are shown in Table 4. A five-point Likert scale was
used with the response options Never=0, A few times each year=1, A few
times each month=2, A few times each week=3, and Every day=4 for all
frequency questions.

**Interviews with directors**

All directors of participating preschools were interviewed individually. Five
of them were interviewed alone, while two were interviewed in the presence
of two teachers who led EfS-related work at the preschool. Three of the
directors were responsible for non-eco-certified preschools, whereas four of
them were responsible for at least one eco-certified preschool. The
interviews lasted between 25 and 45 minutes. After permission was granted
by the directors, all interviews were audio-recorded (total 203 minutes). The
venues for the interviews were chosen by the directors themselves. The
interview questions included both closed- and open-ended questions.

The questions consisted of demography, sustainability-related values and
priority, see Appendix G. The demographic variables included the director’s
sex, number of qualified teachers, number of child attendants, number of
children, eco-certification (Yes=1, No=0), and, if eco-certified, then the
type of eco-certification (Green Flag and Preschool for Sustainable Development).
The value related questions and priority question concerned the importance
of EfS at preschool on a five-point Likert scale ranging from Not at all
important=0 to Very important=4.

**Pre-testing of the instruments**

The instrument for the children was pre-tested with eight children aged five
to six at a non-eco-certified preschool to check the wording of the questions,
appropriateness of illustrations, interview techniques and duration. This
preschool was not included in the main study. Each interview took 10-25
minutes depending on the child’s interest and willingness to participate in
the conversation.

The pre-test results showed that some children still had difficulty
understanding a few terms, such as ‘environment (miljö)’, and ‘afford (ha
råd)’, and used the word ‘nature’ (‘natur’) instead of ‘environment’ (miljö)
and ‘have money’ instead of ‘afford’ (ha råd). The children were also better
acquainted with the word ‘day-care center’ (‘dagis’) than with ‘preschool’
(‘förskola’). These findings were considered in the final version of the
interview questions. During the pre-testing, the use of colored illustrations, a
cuddly puppet, some toys and a sitting mat with pictures of puppies were found to be helpful in creating a friendly atmosphere.

The questionnaire for the guardians was pre-tested on four guardians of a non-eco-certified preschool to identify deficiencies in question design. However, the responses did not suggest a need for revising the questionnaire.

To develop the questionnaire for teachers, three teachers from a non-eco-certified preschool were interviewed individually about their work with EfS at the same preschool where the participating children were enrolled. The interviews were audio-taped with permission from the teachers. Based on the findings of the interviews, the questionnaire for teachers was developed. The preliminary questionnaire was pre-tested on seven additional teachers, which resulted in some changes in wording and format. Face validity of the instruments was assessed by three senior researchers.

Data analyses

This section provides a brief description of the analyses of the qualitative and quantitative data.

Qualitative data analysis

In order to describe the patterns and trends in communicative content, children’s responses to the open-ended questions were subject to content analysis (Weber, 1990). The data were read several times as a means of familiarization, and notes of interesting patterns, inconsistencies and contradictions within and between individuals and groups were kept (Hammersley & Atkinson, 1983). The data were categorized step by step starting with a small section and then gradually with the whole text. Then the categories were examined to find the overarching categories as well as sub-categories.

The analytical tool that was developed based on the SOLO Taxonomy (Biggs & Collis, 1982) was used to analyze and classify children’s justifications for (un)equal economic situations between individuals and countries, the use of money, sharing resources with friends and the environmental impact of different transport modes. Children’s interview data were analyzed in terms of quality and complexity, but not “of how many bits of this and of that they got right” (Biggs, 2016). Examples of how the SOLO Taxonomy was applied in my study to categorize, analyze and interpret children’s logical justifications are given in Table 5. Levels two (unistructural) and three (multistructural) of the Taxonomy demonstrate the quantity of learning outcomes, whereas level four (relational) and five (extended abstract) illustrate the quality of children’s learning outcomes by
the sophistication of their logical and relevant justifications. The levels were scored on a scale ranging from Prestructural=0 to Extended abstract=4.

Table 5. Categorization of children’s responses based on SOLO levels.

<table>
<thead>
<tr>
<th>SOLO levels</th>
<th>Examples from children’s responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prestructural – No relevant idea</td>
<td>Demonstrates no understanding of the topic; pieces of unconnected information or cannot do or carry out the task. For example, the child may say, “I don’t know.”</td>
</tr>
<tr>
<td>Unistructural – One relevant idea</td>
<td>Makes simple connections and does a simple task. For example, the child can say, “Driving a car is bad for the environment.”</td>
</tr>
<tr>
<td>Multistructural – Many relevant ideas</td>
<td>Makes some connections, but the significance of the relationships between connections is missing/not demonstrated. For example, the child may say, “Driving a car is bad for the environment. Harmful gas comes from the car.”</td>
</tr>
<tr>
<td>Relational – Linked ideas</td>
<td>Shows relationships between connections, describes their balance. For example, the child says, “Driving a car is bad for the environment. (Because) The air gets polluted by the harmful gas from the car.”</td>
</tr>
<tr>
<td>Extended abstract – Extended ideas</td>
<td>Demonstrates connections beyond the immediate subject areas and generalizes the specific to the abstract. For example, the child says, “Driving a car is bad for the environment. If you drive so much, there will be too much pollution in the air, and people and animals will suffocate. If we walk to preschool instead, we won’t pollute the air and walking is good for our health.”</td>
</tr>
</tbody>
</table>

Quantitative data analysis

This study applied multivariate analyses in SIMCA P + 14 in two steps (Umetrics, 2015). In step one, the questionnaire data and the SOLO scores of children’s justifications and their responses to the closed-ended questions (i.e., interview data) were subjected to Orthogonal Partial Least Squares
analysis (OPLS) (Trygg & Wold, 2002). The analysis in OPLS was designed to investigate the relationship of children’s knowledge and practices, respectively, with preschool- and home-related practices and factors. Children’s practices (functional knowledge) were represented by their recycling function correctness. This was scored on a scale ranging from Recycled all items incorrectly=0 to Recycled all items correctly=3. Children’s knowledge (declarative knowledge) was based on their SOLO levels in the areas of economic equality, resource sharing, recycling and transport use. To increase the reliability of the estimation of children’s declarative knowledge, their SOLO levels in the four areas were merged into a single score by Principal Component Analysis (PCA), expressing an ‘overall’ knowledge of sustainability issues.

In step two, Orthogonal Partial Least Squares Discriminant Analysis (OPLS-DA) (Bylesjö et al., 2006) was conducted to investigate any differences between eco- and non-eco-certified preschools with respect to the preschool-related practices and factors that were used in step one for predicting children’s knowledge. Variable Importance for Projection (VIP) values were used for determining the relative importance of each ‘characteristic’ of the preschools, i.e., SOLO scores of children’s descriptions of environmental and sustainability issues, and responses to closed-ended questions. Although there is no consensus on how to best compare the relative importance of the characteristics when multicollinearity is present, as was the case in our study, their relative loadings on latent factors, i.e., linear combinations of original variables, in the prediction model have been argued to provide good estimates (Johnson, 2000). VIP values build on this idea and have been shown to perform well for many types of datasets (Chong & Jun, 2005; Galindo-Prieto, Eriksson, & Trygg, 2015). Variables with VIP values larger than 1 are generally considered to be important for explanatory/predictive ability of the model, while variables with VIPs 0.5-1 are of intermediate importance, and unimportant if below 0.5.

To facilitate interpretation and/or increase validity of the measures for some of the data, ‘composite scores’ were calculated. Recycling activity at the preschools was represented by the types of waste (nine different options were given) and the total number of types of waste that were sorted at the preschool. The responses of teachers to these items were subjected to PCA to generate a single score, summarizing the perceived recycling activity at their preschool for each staff member. For each preschool this score was averaged, generating the “Preschool’s recycling, diversity and number of items” score used in subsequent analyses. The same procedure was applied to describe the frequency by which twelve different areas of sustainability issues were discussed with the children at the respective preschool. This score was labelled “Teachers’ frequency of sustainability discussions with children.” An
identical procedure was used for describing the character of the mother’s and father’s frequency of sustainability discussions with their child, and their recycling activity at home. For these measures, no averages were calculated, but the father’s and mother’s scores were used separately. All data were scaled to unit variance to avoid any variables ‘dominating’ others solely due to the magnitude of the scale they were measured on.

To estimate the performance of all models in terms of predictive power for new data, cross-validation (Eastment & Krzanowski, 1982) and cross-validation ANOVA (Stähle & Wold, 1990) were utilized. And to assess any undue leverage of single observations, potentially causing rotation of models to fit extreme values (thereby reducing their ability to properly describe the “normal” data points), Distance to Model (DModX) analysis and Observation Risk (Orisk) Analysis were performed. DModX gives information on whether an observation (i.e., data item related to a child) should be regarded as an outlier or not, while Orisk is an estimate of the effect of a single observation on the models’ predictions (i.e., the residuals of the model when the observation is part of the model, compared with when it is not).

The critical value of DmodX is calculated from the F-distribution. An observation was considered an outlier if the DmodX value was more than twice as large as the critical value. An observation risk of 1 or lower means that there is no difference in residuals. Observations with an observation risk exceeding 1.5 were excluded, and new models were computed and compared with the original model, with respect to loading patterns and descriptive ($R^2$) and predictive ($Q^2$) ability.

Validity and reliability

This section briefly discusses the concepts of validity and reliability in relation to qualitative and quantitative research, and describes how these concepts have been applied while I designed my study, developed the instruments, and collected and analyzed data. As the study utilized a mixed methods approach, it is crucial to illustrate how these concepts were understood in relation to both qualitative and quantitative approaches.

Validity and reliability are often viewed as concepts that are associated with positivistic concepts, which do not necessarily have a straightforward meaning in qualitative research (Golafshani, 2003; Stenbacka, 2001).

To emphasize the importance of validity in any study, Cohen, Manion and Morrison (2011) claim that validity is a requirement and without it any research is worthless. In a qualitative study, validity refers to the honesty, trustworthiness, credibility and way in which the participants were approached, whereas in a quantitative study, validity relates to careful sampling, appropriate data collection instruments and suitable statistical analysis of data (Cohen et al., 2011). In quantitative research, it is important
to construct an instrument to be administered in a standardized manner following predetermined procedures (Crocker & Algina, 1986). The reason for this is to ensure that the measuring instrument measures what it is intended to measure. The validity of an instrument is tightly linked to its ability to produce results that are intelligible, reapplicable and/or repeatable. In contrast, qualitative researchers seek a certain quality through routinely employed member checking, triangulation, rich description and peer reviews (Creswell & Miller, 2010).

Reliability in quantitative research refers to repeatability or replicability of a measure of a concept and is mainly concerned with consistency and accuracy over time (Cohen et al., 2011). In qualitative research, the concept of reliability is considered to be irrelevant, because interviewing repeatedly may sensitize a person to the subject matter, and thus generate new or different responses. However, in any qualitative research, repeatability or replicability have their limitations, but the transparency of methods that were used to collect data could support trustworthiness.

Even though validity and reliability are distinguishable, they nevertheless relate to each other. In fact, a measure is not reliable if it is not valid (Bryman, 2008). However, Patton (2002) argues that any qualitative researcher needs to be concerned about validity and reliability while designing a study, analyzing data, discussing results and assessing the quality of the study. To establish credibility in a qualitative study, Creswell and Miller (2010) argue that it is important that the settings, the participants and the themes are described in detail, which this study has done above.

In my research, the concept of validity has been considered through the selection of appropriate methods. The sample was chosen from equal numbers of eco-certified and non-eco-certified preschools that would facilitate a comparison between those two types of preschools in terms of children’s knowledge and practices. To minimize bias of children’s demographic backgrounds, such as families’ educational, professional, economic and socio-cultural backgrounds, the intention was to select each set of eco-certified and non-eco-certified preschools geographically as close as possible. However, this was not achieved, due to the fact that not all municipalities in Sweden have preschools that work explicitly with EfS.

In my study, a qualitative approach was used to collect data from children considering their age group, language efficiency, level of reading and writing capacity, and the importance of creating a playful environment. This study used a rich description of how children were interviewed using semi-structured interview questions and also combined the interviews with observation of recycling activities.

While developing the semi-structured interview instrument for children, questionnaires for guardians and teachers, as well as the semi-structured interview questions for directors, I assessed the face validity by discussing
the concepts with three experienced researchers. Pre-testing of the instruments was done to construct instruments to be administered in a standardized manner following predetermined procedures (Crocker & Algina, 1986). The reason was to ensure that the measuring instruments measure what they are intended to measure. The qualitative parts, which included interviews with children and directors, have included a transparent and rich description about how the interviews were carried out. I used the same set-up to interview children at all preschools by using my own sitting mat, toys, cuddly puppet, illustrations and recycling items to create a similar environment.

The concept of validity can be traced in the systematic and careful development of an applicable and practical conceptual framework. The conceptual framework developed for my study defined the complexity of the concept sustainability within the environmental, social and economic dimensions. All dimensions of sustainability were operationalized using different theoretical perspectives, and an analytical tool was developed to analyze children’s justifications.

To increase the reliability of the estimation of children’s knowledge, their SOLO levels on the four themes were merged into a single score by PCA, which shows ‘overall’ knowledge of sustainability issues. OPLS analyses were conducted to investigate the importance of preschool- and home-related factors to explain children’s responses and describe the differences between eco-certified and non-eco-certified preschools. To understand how the results of the analyses would generalize to an independent data set, i.e., being representative of all children, preschools, teachers, directors and guardians, cross-validation (Eastment & Krzanowski, 1982) and cross-validation ANOVA (Ståhle & Wold, 1990) were performed. And to check that the findings were not the result of a few extreme observations, Distance to Model (DModX) Analysis and Observation Risk (Orisk) Analysis were performed.

**Ethical considerations**

As this research involves human participants, both children and adults, an ethical vetting was sought from the Regional Ethical Review Board. The Board ascertained that the research project was not covered by the Ethical Review Act and the advisory opinion board stated that they did not see any ethical problems with the project.

All participants involved in the research were informed in writing about the study, see Appendices A, B and C. They were informed that participation was completely voluntary. The participants could discontinue or dismiss their participation at any time without any reason being given. Confidentiality was taken into consideration while the study was conducted.
This study followed the principles of ethical research and practice of the Swedish Research Council (Vetenskapsrådet, 2011).

Informed consent to participate in the study was obtained from preschool directors at the beginning of the study in terms of the participation of their preschools. Regarding the participation of children, informed consent was obtained from the guardians as well as from the children themselves. As teachers and the guardians participated in surveys, they received questionnaires with information about the study. They consented to their participation in the survey by completing and returning the questionnaire in a prepaid envelope (The Ethical Review Act, 2003:460).

Data are preserved securely for the appropriate period of time as instructed by the ethical committee, and unauthorized individuals do not have any access to the information. Data are treated as confidential under the Personal Data Act (Personuppgiftslag, PUL 1998:204) and stored in accordance with the recommendations of the Data Inspection Board.
Results

In this chapter, the findings are presented in relation to the objectives of the study under four main headings: Children’s self-reported knowledge and practices of sustainability, Comparisons between eco-certified and non-eco-certified preschools, Influences of preschool and home on children’s learning for sustainability, and Children’s self-reported sources of knowledge.

Children’s self-reported knowledge and practices of sustainability

The findings from the content analysis of children’s responses concerning economic equality, resource sharing, transport use and recycling are presented under the following categories: Economic situation of other children in the world, Use of money, Sharing resources, Environmental impact of different transport modes, and Recycling of different items.

Economic situation of other children in the world

Preschool children’s knowledge and views of the economic situation of other children in the world were explored in paper I. Overall, the results indicate that nearly all (94.3%) of the children had knowledge about poverty in the world and were aware of economic inequalities in society. In response to the question as to whether all children in the world could afford to buy new toys from a shop or not, most (88.7%) of the children opined that it is not possible for all children in the world to buy new toys from a shop, the main reason being poverty among and between individuals and countries. One child stated that “some people don’t have money, but some people have a lot of money. Some people can be very rich. The King is rich” (Child #5). A few (5.7%) participating children assumed that all children in the world can buy toys from a shop if they want to, but according to them not all children might want to buy toys from a shop. An equal proportion (5.7%) of children mentioned that they did not know whether all children could afford to buy new toys from a shop or not.

Not only did the study show that nearly all (94.3%) of the children had knowledge about the economic situation of other children in the world, they also seemed to have an ability to associate various social aspects related to people’s education, jobs and lifestyles. For example, a few (7.6%) children could relate other children’s ability to afford things to the education level of their parents, and the parents’ low salaries or unemployment. One child argued that “all children in the world cannot afford to buy toys from a shop, because their parents cannot earn that much money. They have not studied in a good school. They are poor” (Child #32). According to this child (#32),
buying toys requires more money, and the earning of more money can relate to schooling. Another key point mentioned by one child was that “some countries are poor and children in those countries must work. Their mom and dad don’t have much money” (Child #40). The description of this child (Child #40) showed that she/he probably knew about the lives of poor people in low-income countries where children are obliged to work for their survival.

The children’s descriptions of other children’s economic situations and their ability to buy new toys were mixed with their feelings, sense of responsibility, some sort of values, personal liking and disliking. In this regard, one child stated that:

Some people cannot buy toys from a shop. They are poor, they have very little money. Poor people cannot even afford to buy food for their children. We have a cottage at our place, where some poor people come and sit and they live there. We take them in our cottage. We give them food. People should help the poor. I want to give some money to them. (Child #28)

These findings indicate that children from other countries and their parents were frequently viewed as poor, and that they lived under difficult circumstances and could not afford to buy toys.

**Use of money**

Preschool children’s knowledge and self-reported behaviors concerning how to use money, and their willingness to share resources with friends were explored in paper II. Based on the content analysis concerning children’s responses of the use of money, five categories emerged: *Shopping*, *Saving*, *Donating*, *Traveling* and *Don’t know*, see Figure 10.

All children, except one (Child #33), knew what to do with their money if they were to receive any. Nearly one fourth (24.5%) of them could come up with more than one idea about this issue.

**Shopping**

It was noted that a large majority (81.1%) of the participating children wanted to use their money to buy toys, candies, ice cream, pets and other things. For instance, one child responded that “I want to buy cars, toy cars” (Child #5), and another one said that “I would buy something good” (Child #1). Thus, the children considered money to be somehow related to buying goods, or spending on something they would like to have, which indicates their intention to consume.
Children’s ideas about how to use money if they were to receive any.

**Saving**

Saving money seemed to be a known concept to about one third (34.0%) of the participating children. They wanted to save money to be rich and to be able to buy more expensive things in the future, for example, trampolines or remote-control cars. In terms of how to use money, some (13.2%) of the children considered savings as a way to be able to buy more goods. One child argued that “If I had money, I would save it or buy something with it. If you save, then you can buy more things with your money” (Child #41).

**Donating**

Some (13.2%) children wanted to donate money. A few (5.7%) of them wanted to donate money to the poor if they were to receive any. They were concerned about the economic situation of the poor and their limited ability to enjoy their lives. One child elaborated on this, saying:

If I had money, I would give it to the poor, because they don’t have so much money. They cannot do anything. Because poor people have very little money. Imagine if they only have 10 crowns and don’t have anything else. Then I would like to give some money to them. (Child #28)

The remaining (7.5%) children mentioned that they would like to share some money with their parents and siblings. Regarding sharing money, one child (Child #18) stated that “I would give my money to my mother and father”.

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**Figure 10.** Children’s ideas about how to use money if they were to receive any.
Traveling

To use money for services, such as traveling, instead of goods was not a common idea among the participating children. Only one child (Child #1) mentioned that she/he would like to use money to visit other countries, while no other children talked about using their money for visiting places.

Resource sharing

In paper II, this study also explored children’s self-reported knowledge and practices on the theme of resource sharing using candy as an example of young children’s possession. Nine out of ten (90.6%) of the participating children wanted to share their candies with friends. None of them wanted to give away all their candies to friends. The children varied in their justifications for sharing or not sharing candies with friends. Based on the most significant aspects of their responses, three categories emerged: Care for others, Fairness and social responsibility and Self-regard.

Care for others

About one third (32.1%) of the children’s responses were somewhat related to caring for others. The children wanted to share candies with friends, knowing that it is kind to do so. They described the reason for sharing as being that they do not want their friends to be sad. They also explained that it is mean not to share with others and to keep everything for oneself. For example, one child stated that:

I will give some candies to my friend. I will share... sharing with others means you are kind and the boy (in the illustration Figure 7) will be happy. You should be kind to your friends. It is not nice to keep everything for yourself. (Child #28)

The children’s justifications for sharing candies with their friends indicated that they seemed to care a great deal for their friends, and that they considered kindness towards other people to be something important.

Fairness and social responsibility

Regarding sharing candies with others, the responses of nearly one quarter (22.6%) of the children were about being fair and just. To some extent, sharing with those who do not have candy was seen as an obligation. For example, one child argued that “I would give half of my candies to my friend, who doesn’t have any. Because we should have an equal share. Otherwise it is not fair. People should share with each other” (Child #18). The child’s justification for sharing extended to the ideas of being fair and socially
responsible. Similarly, another child stated that “I will share an equal amount of candies with my friend, otherwise it will be unfair” (Child #25).

Self-regard

Although most children wanted to share candies with their friends, not all participating children were willing to do so without reflecting on the possible consequences. Some (11.3%) of the children were concerned that sharing with others might lead to their running out of candies or resources. For example, one child raised a question about personal responsibility and argued that “I will never give any candies to anyone. If you would like to eat candies, you should buy them yourself. I will hide somewhere to avoid sharing things with others” (Child #31). Although willing to share half of the candies, another child noted that “I would give half so that half of the candies are left for me, otherwise everything will be finished” (Child #15).

Environmental impact of different transport modes

Children’s knowledge about the environment and the environmental impact of various transport modes (bus, car, bicycle and walking) were explored and presented in paper III. Almost half (49.1%) of the children knew the word ‘environment’ (‘miljö’ in Swedish). In general, the children described the environment as being their world, their home or a place where all people can live. The descriptions related to their own experiences in nature, their emotions and the values associated with their liking and disliking. Their descriptions were frequently mixed with a sense of responsibility towards Earth and all living creatures on it.

One child stated that the environment is a place outside “…where people should not throw any rubbish or pieces of glass. Animals can eat them and get problems or pain in their tummies. People should pick up rubbish and put it in the rubbish bin” (Child #43). Two (3.8%) children connected the cause and effect of human acts on the environment, such as “It [environment] is a place where we live. People should not make the environment dirty and should not throw rubbish into the sea because then fish will die” (Child #39). Eighteen (34.0%) of the children did not recognize either the word environment or nature.

Regarding the environmental impact of traveling by bus, car, bicycle and foot, the children in general considered the bus and car as harmful modes of transport for the environment, see Figure 11.
Nearly half (47.2%) of the children reported that travelling by car was harmful for the environment. One child argued that:

> Driving a car is bad, because a car emits a lot of harmful gas. Walking is very good; then you don’t emit a lot of exhaust gas or you don’t fall on the ground [as one could from a bicycle]. That is why walking is very good for the environment. People may inhale harmful gas and can get sick. Trees can become sick. (Child #2)

In general, the children’s responses indicated that they knew that harmful gases from cars and buses cause air pollution, which they could relate to the extinction of life and damage to Earth.

Just over half (52.8%) of the children viewed buses as being environmentally unfriendly modes of transport, whereas some (16.9%) of them responded that travelling by bus was very good for the environment, at least to some extent. One child was in favor of travelling by bus, arguing that “Travelling by bus is good, because there are seats for many people” (Child #43). The argument showed that the child had knowledge about public transport where many people could travel together.

The economic impact of excessive use of cars and buses was identified by a few (5.7%) children, who could associate the use of cars and buses with the economic dimension of sustainability, addressing the limitation of natural
resources. Their argument was that if someone drives a car a lot then there would not be any fuel left and the batteries would be finished as well.

In general, the participating children had some knowledge about zero-emission transport modes. Cycling and walking were frequently mentioned as being environmentally friendly. Cycling was reported as being very good for the environment and for one’s health by more than half (58.5%) of the children. The reason was that “…it is a way of doing exercise. Driving a car so much is not good for the environment. Harmful gas comes out from the car, the environment gets full of smoke and we can inhale harmful gas” (Child #12). On the contrary, one (1.9%) child viewed cycling as being bad for the environment, whereas most of the participating children stated that they liked cycling and considered it exciting, although they were yet to learn how to ride a bicycle safely. Walking was reported as being very good for one’s health and the environment by about half (54.7%) of the children, “…because then you use your legs. If you walk, then you don’t emit any harmful gas” (Child #23). However, one in five (20.8%) of the children considered walking to be bad for the environment. Their justifications were related to personal discomforts, sore legs and the risk of accidents, as well as to what they had heard from adult.

Recycling of different items

Preschool children’s self-reported knowledge and practices concerning the sorting of different recycled items were investigated and reported in paper IV. Concerning children’s participation in recycling activities at home and at preschools, the findings showed that a large majority (79.2%) participated in sorting different items at home and nearly two thirds (64.2%) mentioned that they participated in recycling activities at preschool.

Irrespective of children’s participation in recycling activities at home and/or preschool, observations of their recycling activities demonstrated that all participating children had knowledge about how to sort items for recycling (a banana peel, a cola can and a plastic bottle). All children recycled at least two out of three items correctly, and nearly half (41.5%) of them recycled all three items correctly.

According to the children, the most sorted items at preschools were reported to be paper (n=25), toys (n=24), compostables (n=17) and bottles/cans (n=14). Likewise, at home compostables (n=27), bottles/cans (n=25) and paper (n=16) were mentioned most frequently by them.

In response to the question about what the children usually do with the bottle after they have drunk a bottle of soft drink or juice, almost two thirds (64.2%) of the children stated that they usually recycle it. However, some (24.5%) children stated that they throw it away, and a couple (3.8%) of them reported that they played with it. A few (7.6%) children did not say anything.
The overall results of functioning knowledge showed that the children seemed to have acquired a great deal of knowledge about how to sort different recyclable items. Their self-reported practices indicated that many of them participated in sorting items at home as well as at preschool.

**Preschool- and home-related factors and children’s learning for sustainability**

To investigate how preschool- and home-related factors are associated with children’s knowledge and practices of sustainability, an OPLS analysis was conducted. The six variables with the strongest association with children’s declarative knowledge of sustainability issues were preschool-related, whereas the six variables with the weakest association and the two with negative associations were all home-related, see Table 6. Variables considered to be important for the predictive ability of the OPLS model, and with a positive relation to children’s declarative knowledge of sustainability, related to preschools or their activities with the children. The variable *Household owns car* had a negative association and was of intermediate importance. Also, guardians’ *recycling frequency at home* without involving children was negatively associated with declarative knowledge, but the importance was low.

**Table 6.** VIP values of preschool- and home-related variables predicting children’s declarative knowledge of sustainability issues. A positive valence means the variable is positively associated with children’s declarative knowledge.

<table>
<thead>
<tr>
<th>Variable</th>
<th>VIP</th>
<th>Valence of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teachers’ perceived importance of EfS at preschool</td>
<td>2.11</td>
<td>Positive</td>
</tr>
<tr>
<td>Level of priority of EfS at preschool</td>
<td>2.09</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ frequency of sustainability discussions with children</td>
<td>1.69</td>
<td>Positive</td>
</tr>
<tr>
<td>Composite trash bin availability</td>
<td>1.65</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ frequency of recycling station visits with children</td>
<td>1.09</td>
<td>Positive</td>
</tr>
<tr>
<td>Preschool’s recycling, diversity and number of items</td>
<td>1.00</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s frequency of sustainability discussions with child</td>
<td>0.99</td>
<td>Positive</td>
</tr>
<tr>
<td>Proportion of teachers with training in EfS</td>
<td>0.93</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s reported frequency of child’s participation in recycling</td>
<td>0.91</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s frequency of sustainability discussions with child</td>
<td>0.87</td>
<td>Positive</td>
</tr>
<tr>
<td>Household owns car</td>
<td>0.87</td>
<td>Negative</td>
</tr>
<tr>
<td>Mother’s public transport use frequency</td>
<td>0.69</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s frequency of recycling station visits with child</td>
<td>0.48</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s frequency of recycling station visits with child</td>
<td>0.46</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ frequency of recycling activity with children</td>
<td>0.32</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s reported frequency of child’s participation in recycling</td>
<td>0.26</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s recycling, diversity and number of items</td>
<td>0.23</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s recycling, diversity and number of items</td>
<td>0.19</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s recycling frequency at home</td>
<td>0.13</td>
<td>Negative</td>
</tr>
<tr>
<td>Father’s public transport use frequency</td>
<td>0.09</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s recycling frequency at home</td>
<td>0.08</td>
<td>Negative</td>
</tr>
</tbody>
</table>
Children’s functional knowledge (practices) in terms of recycling correctness was positively associated with visiting the recycling station with teachers and the recycling habits (types of waste sorted) of the preschool, whereas children’s functional knowledge in terms of recycling correctness was negatively associated with visiting recycling stations with guardians, guardians’ recycling frequency at home, and teachers’ frequency of sustainability discussions with children, see Table 7.

Table 7. VIP values of variables predicting children’s functional knowledge, sorted from highest value to lowest. A positive valence means the variable is positively associated with recycling function correctness.

<table>
<thead>
<tr>
<th>Variable</th>
<th>VIP</th>
<th>Valence of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother’s recycling, diversity and number of items</td>
<td>2.64</td>
<td>Negative</td>
</tr>
<tr>
<td>Teachers’ frequency of recycling station visits with children</td>
<td>2.16</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s recycling frequency at home</td>
<td>1.56</td>
<td>Negative</td>
</tr>
<tr>
<td>Mother’s recycling frequency at home</td>
<td>1.40</td>
<td>Negative</td>
</tr>
<tr>
<td>Teachers’ frequency of sustainability discussions with children</td>
<td>1.24</td>
<td>Negative</td>
</tr>
<tr>
<td>Father’s recycling, diversity and number of items</td>
<td>0.97</td>
<td>Negative</td>
</tr>
<tr>
<td>Household owns car</td>
<td>0.96</td>
<td>Negative</td>
</tr>
<tr>
<td>Preschools recycling, diversity and number of items</td>
<td>0.77</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s frequency of recycling station visits with children</td>
<td>0.71</td>
<td>Negative</td>
</tr>
<tr>
<td>Teachers’ frequency of recycling activities with children</td>
<td>0.56</td>
<td>Negative</td>
</tr>
<tr>
<td>Mother’s reported frequency of child’s participation in recycling</td>
<td>0.52</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s frequency of sustainability discussions with child</td>
<td>0.52</td>
<td>Positive</td>
</tr>
<tr>
<td>Level of priority of EFS at preschool</td>
<td>0.45</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s public transport use frequency</td>
<td>0.32</td>
<td>Negative</td>
</tr>
<tr>
<td>Proportion of teachers with training in EFS</td>
<td>0.28</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s reported frequency of child’s participation in recycling</td>
<td>0.26</td>
<td>Positive</td>
</tr>
<tr>
<td>Composite trash bin availability for children at preschool</td>
<td>0.20</td>
<td>Positive</td>
</tr>
<tr>
<td>Mother’s frequency of sustainability discussions with child</td>
<td>0.19</td>
<td>Positive</td>
</tr>
<tr>
<td>Father’s public transport use frequency</td>
<td>0.19</td>
<td>Negative</td>
</tr>
<tr>
<td>Mother’s reported frequency of recycling station visits with child</td>
<td>0.16</td>
<td>Negative</td>
</tr>
<tr>
<td>Teachers’ perceived importance of EFS at preschool</td>
<td>0.13</td>
<td>Positive</td>
</tr>
</tbody>
</table>

Comparisons between eco-certified and non-eco-certified preschools

Comparisons between participating eco-certified and non-eco-certified preschools were made in terms of children’s knowledge and practices of economic equality, resource sharing, recycling and transport use to explore whether or not eco-certification plays a role for children’s knowledge and practices in this regard. No statistically significant differences were found.

The content analysis of children’s justifications related to economic equality, resource sharing and transport use themes using the SOLO Taxonomy showed that children at eco-certified preschools tended to have a
higher degree of logical complexity in their responses compared with children at non-eco-certified preschools, see Figure 12.

**Figure 12.** Proportion of children in eco-certified and non-eco-certified preschools that responded at Surface learning or Deep learning levels by theme.

Children at eco-certified preschools often demonstrated a deeper understanding by connecting ideas, or even creating a new understanding at a higher level on the above-mentioned themes, compared with those at non-eco-certified preschools, although the difference for transport use is small. However, these tendencies were not statistically significant.

In the OPLS-DA, aiming to discern whether and how eco-certified and non-eco-certified preschools differ, one significant predictive component was identified. It used 8% of the variation in children’s knowledge about the environmental impact of different transport modes (paper III), source of knowledge, and location of preschool to predict 35% of class membership, i.e., eco-certified or non-eco-certified preschool.

The relative importance (i.e., the variable importance for projection (VIP) values) of the measured variables for predicting eco-certification of the preschools are shown in Figure 13.

Along with VIP values above 1, the confidence intervals indicate that the location of the preschool was the only important variable for predicting eco-certification of the preschools (i.e., explaining the differences between eco-certified and non-eco-certified preschools). Being knowledgeable (or not) about the environmental impact of bus transport, as well as the SOLO levels
of the children’s descriptions of the effect of cars on nature, was also significant, but of low importance for the prediction (VIP value below 1).

Figure 13. Relative importance (VIP values) of the independent variables used in the OPLS-DA model for predicting eco-certification of preschools.

The loading pattern of these variables in the OPLS model mostly reflects the fact that the preschools located in towns were mainly non-eco-certified, while the eco-certified preschools were mainly found in large cities. When the location of the preschool was removed from the model, no significant differences between eco-certified and non-eco-certified preschools were
found. This demonstrates that the participating children’s knowledge about sustainability issues was not associated with eco-certification.

The relation between preschool-related factors and eco-certification was investigated in paper IV. As shown in Table 8, eco-certification was positively associated with the availability of trash bins, preschool directors’ priority of EfS, teachers’ perceived importance of EfS, recycling station visits with children, and teachers’ sustainability discussions with children. The extent of EfS training among the staff, and the frequency and scope of recycling activities with the children, did not differ much between eco-certified and non-eco-certified preschools.

Table 8. VIP values of preschool-related variables predicting eco-certification of the preschool. A positive valence means the variable is positively associated with eco-certification (as opposed to non-eco-certification).

<table>
<thead>
<tr>
<th>Variable</th>
<th>VIP</th>
<th>Valence of relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>Composite trash bin availability</td>
<td>1.51</td>
<td>Positive</td>
</tr>
<tr>
<td>Level of priority of EfS at preschool</td>
<td>1.26</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ perceived importance of EfS at preschool</td>
<td>1.16</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ frequency of recycling station visits with children</td>
<td>1.14</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ frequency of sustainability discussions with children</td>
<td>1.12</td>
<td>Positive</td>
</tr>
<tr>
<td>Proportion of teachers with training in EfS</td>
<td>0.35</td>
<td>Positive</td>
</tr>
<tr>
<td>Teachers’ frequency of recycling activities with children</td>
<td>0.26</td>
<td>Positive</td>
</tr>
<tr>
<td>Preschools’ recycling, diversity and number of items</td>
<td>0.18</td>
<td>Negative</td>
</tr>
</tbody>
</table>

Moderate amounts of variation in children’s declarative knowledge and functional knowledge were described by the OPLS models, but cross-validation indicated that the models were non-significant, see paper IV. This result was supported by a two-tailed t-test for declarative knowledge (p=.079) and a Mann-Whitney U test for functional knowledge (p=.172).

**Children’s self-reported sources of knowledge**

The findings concerning children’s self-reported sources of knowledge on economic equality, resource sharing, recycling and transport use are presented in this section. It should be noted that the children were allowed to report more than one source on each theme. Regardless of the themes, the results showed that the parents (guardians) were, in general, reported to be the instrumental source of young children’s knowledge along with the children themselves. The children also considered the preschool (which included teachers) and media to be their sources of knowledge.

In terms of children’s knowledge about the economic situation of other children in the world under the economic equality theme, one third (34.0%) of the children provided more than one source of knowledge. Apart from
parents (45.3%), about one fifth (20.8%) of the children reported media (TV, film and books) and nearly one tenth (11.3%) considered preschool to be their sources of knowledge in this regard. When the children reported themselves as being sources of knowledge, this might mean that they knew about the economic situation of others through personal experience. Nearly one fifth (18.9%) of the children mentioned that they had seen poor people: this was also a way to say that they knew through personal experience, and nearly one quarter (22.6%) of the children reported that they themselves were their source of knowledge. These two responses have been merged into one category ‘own idea’ (constituting 41.5%) in Figure 14.

![Figure 14](image)

**Figure 14.** Children’s self-reported sources of knowledge on *economic equality, resource sharing, recycling* and *transport use.*

Rather than learning about economic (in)equality in our society in preschool, children mentioned that they learned about it through their observations in real-life situations, for example, by seeing beggars in the street or outside shops who did not have job or any money. The children had also noticed that they were increasing in number in Sweden. For example, one child stated that:

[T]here are people, who often come to Sweden, sit beside shops, they are poor. Actually, they come here and there are more and more of them. Some of them did not have any money in the beginning. (Child #43)
Another child stated that “I saw a beggar outside the shop and someone asked my dad if he could give a little money to her. But my dad did not have so much money left. So, he could not give much” (Child #17). Siblings were also mentioned as being a source of knowledge. One child stated that “My brother and his friends collect money to support the poor people. So I know that they don’t have much money” (Child #16).

On the theme resource sharing (paper II), nearly all (94.3%) of the children could give their sources of knowledge. According to them, one third (34.0%) of the children learned about sharing with others from their parents and another third (34.0%) claimed that it was their own ideas or knowledge. Preschool and teachers were also reported as being sources of knowledge in this regard by some (22.6%) of the children.

Concerning main knowledge sources on the recycling theme (paper IV), nearly half (45.3%) of the children stated that they had learned how to sort different recycled items from their parents, while about one third (34.0%) considered themselves to be their source of knowledge. One quarter (24.5%) of the children reported preschools to be their knowledge source, while a few mentioned TV/media (5.7%) and their siblings (3.8%) to be the sources of their knowledge.

Regarding transport use and its impact on the environment (paper III), it was again parents who were reported as being the main sources of knowledge by nearly half (41.5%) of the children, and preschools were mentioned as being sources of knowledge by a few (9.4%) children. Similar to the other two themes, one third (34.0%) of the children felt themselves to have acquired knowledge about the environmental impact of different transport modes on their own or from their own ideas.
Discussion

This chapter discusses the findings and methods of this study under the following headings: Children’s knowledge and practices of sustainability, Influences of preschool and home on children’s learning for sustainability, Comparisons between eco-certified and non-eco-certified preschools, Children’s self-reported sources of knowledge, and Methods discussion.

Children’s knowledge and practices of sustainability

In this section, children’s knowledge and practices of issues related to social, economic and environmental dimensions of sustainability are discussed.

Children’s economic situation in the world

In general, the children in this study seemed to have knowledge about poverty and inequality among and between individuals and countries. Some of them viewed children in other countries as being poor and having parents who did not have an education or a good job. Africa was mentioned as an example of a place of poverty, and, according to some of the children, only poor people live there. As this picture is only partially true, children need to learn more about the lives of others who live in different countries so as to gain a fair understanding of the world. Otherwise, children may develop a stereotype understanding of people who are different.

Earlier studies have shown that by the age of six, children develop some awareness about social and economic issues related to people that belong to various national groups, and that they also acquire some knowledge of and beliefs about foreign countries and people (Barrett & Short, 1992; Furby, 1979; Jahoda, 1962; Lambert & Klineberg, 1967; Piaget & Weil, 1951). Even though these studies were conducted in the previous century, there are similarities to my study when it comes to children’s knowledge of foreign countries and people. According to Wals (2017, p. 163), it is a challenge in our time to know “how to live lightly, equitably, meaningfully and empathically on Earth” and what (pre)school can do to engage children meaningfully in such issues. This is particularly important since we know both that the patterns of what children learn at a young age remain in their minds and that it gets difficult to unlearn these in later stages in life (Hofstede et al., 2010). Therefore, preschool needs to integrate topics related to social sustainability that are suitable for young children and that help them to increase their global knowledge and awareness so they can become responsible citizens of this world.
The use of money

With regard to using money, a large majority of the children in my study considered money to be used mainly for the consumption of goods. In addition, they wanted to save to be rich in order to buy more expensive things in the future. These findings are similar to those in earlier studies where children also wanted to buy sweets, toys and Pokémon cards with their money (Berti & Bombi, 1981; Näsman & von Gerber, 2002). Several studies related to children’s savings have reported that by the age of six, children have learned about the effects of saving, and their saving behavior increased as they grew older (Furnham & Thomas, 1984; Sonuga-Barke & Webley, 1993). According to Siraj-Blatchford, Smith and Pramling Samuelsson (2010), there is little work being done at preschool to have children learn about the economic dimensions of sustainability. To address this dimension, preschool could include simple economic issues, such as pocket money, use of possessions (candies or toys), or savings, in their daily curriculum activities as points of discussion with children as both my study and the studies of others demonstrate that they already know and can learn about such issues. It is important to note that any topic or subject matter needs to be appropriate for the level of the child’s understanding.

A few children in this study stated how they wanted to donate money. These examples of altruistic consumption are consistent with the findings of Näsman and von Gerber’s (2002) study. However, their example was restricted to benefiting only the family members of the children in the study. The extension of donating money to the poor, as found in my study, may be a result of today’s children having a greater awareness of the global situation regarding the increasing number of refugees, or the more recent and visible phenomenon of migrants begging in Sweden.

As mentioned previously, children are growing up in an unsustainable consumer society, where each year an estimated 1.3 billion tonnes of food is wasted, while nearly one billion people go hungry and more than one billion people do not have access to fresh water (United Nations, 2017). Children learn about these problems through media, through personal meetings with people, or through other sources, which have also been noted by Davis (2015). Therefore, it is necessary for adults to communicate with children about these issues to help them develop their ideas and thoughts. Similarly, Pramling Samuelsson (2011, p. 107) points out that teachers can greatly help children understand “how people’s lifestyles, nature and society are related to each other”.

Sharing resources with friends

Some of the children in my study viewed sharing with others as being a social responsibility or a moral obligation, while others considered it as being fair.
These qualities have been emphasized in the Swedish National Curriculum for the Preschool for developing “the child’s sense of empathy and concern for others” (Skolverket, 2011, p. 3). In addition, the responses of most of the children in my study show that they wanted to share resources with their friends and that they wanted to be fair. These qualities are often considered important in the creation of a sustainable society, where people can live together in harmony with nature and with other humans and with the non-human world, something Davis (2015) emphasizes. Johansson and Johansson (2003) argue that children learn to master the moral rules in school, as well as what to say or how to feel in talks with their peers. According to Johansson and Johansson (2003), my findings may be interpreted as being such that the children had learned to express themselves in a politically correct manner. However, it may also be the case that they had in actual fact learned the values and norms that contribute to a sustainable society. Nevertheless, some children in my study expressed concern about sharing resources with friends, opining that sharing means reducing their own resources (i.e. candies), and a couple of them did not want to share any candies at all. Even though some of the children may have responded in accordance with what they thought was expected of them, other children freely shared their opinions and were not impeded by what is considered politically correct. In times of increased problems and unstable living conditions of people, children need to learn how to live as responsible social beings who can contribute to a more sustainable society.

**Sorting of recyclable items**

The recycling activities demonstrated that all preschool children in this study knew how to sort different recyclable items. They also participated in recycling activities at home and at preschool. During the recycling activity game, nearly half of the children sorted all items correctly and none sorted all items incorrectly. With knowledge of the self-reported practices of recycling activities that children regularly participated in both at home and at preschool, this result was not unexpected. This finding is also consistent with the results of a survey in Poland on children’s attitudes, which found that 95% of the participating children cared about keeping their environment clean and 30% of the children sorted waste at home (Grodzieska-Jurczak et al., 2006).

Although most of the children in my study reported that they sorted bottles or cans after they had drunk pop or juice, some of them stated how they threw them into the regular garbage, which, as we know, is harmful for the environment. As a matter fact, every year 5-13 million tons of garbage ends up in the sea (Keep Sweden Tidy, 2017). Plastic, which is a material that degrades very slowly, has been found to be the most common object in the
sea (Keep Sweden Tidy, 2017; Wals, 2010). This affects the lives of fish, birds and other species. Wals (2010) points out that approximately 80% of the garbage in the sea comes from land and the remaining 20% comes from ships. As plastic garbage products are often used only once by consumers, we can improve the unsustainable recycling situation by sorting our daily waste. To keep the planet clean and healthy, children as Earth’s future citizens need to learn how to be engaged in practical activities related to sustainability. The importance of children’s participation in sustainability-related activities has also been emphasized by, for example, Davis (2005), Lewis et al. (2010) and Mackey (2012). Based on the findings of my study, which showed statistically significant relationships between children’s learning for sustainability and influences at home and preschool, both home and preschool may well be ideal places for children to learn how to sort different items and to develop sorting habits. A major reason for starting such learning at an early age is current evidence showing that early childhood education is effective in developing children’s attitudes and behaviors (Muennig et al., 2011; Siraj-Blatchford et al., 2008). To create a sustainable future, it is essential for Earth to be clean and healthy and to be a planet where everyone – humans and non-humans – can live side by side.

Environmental impact of different modes of transport

A substantial proportion of the children in my study were not familiar with the basic words ‘environment’ (miljö) or ‘nature’ (natur). This finding was unexpected since preschools in Sweden have a long history of working with nature and environmental issues (Pramling Samuelsson, 2011). One would therefore expect that a final-year preschool child would have come across and become familiar with these words. One reason for this seemed to be that children had a limited vocabulary rather than limited knowledge about the environment. Some teachers used ‘kids’ words’, for example, ‘outdoor day’ (utedag) or ‘outdoor activities’ (uteaktiviteter) or ‘forest’ (skog) instead of using the words ‘environment’ or ‘nature’.

In general, the children seemed to know that harmful gases from cars and buses cause air pollution, which they could relate to the extinction of life and damage to the planet and which are identified as challenges for social sustainability (UNESCO, 2006). Some of the children had knowledge about traveling by public transport, which they considered to be environmentally friendly, since many people could travel together by bus. This result indicates that children are aware of the fact that when many people travel together in public transport, the use of private cars can be reduced and eventually so can the burden on the environment. This is similar to what Baslington (2009) found – namely, that children responded in favor of using public transport since it was an environmentally friendly means of traveling.
Although most of the children in my study were aware of the environmental impact of various modes of transport, some children were not. Therefore, the topic transport use could be integrated into preschool curriculum activities discussing how our choices and lifestyles can have an impact on the environment and how everything is connected.

Although the word ‘climate change’ was not mentioned by the children, their responses addressed issues related to environmental problems, health issues and the extinction of animals. With their concern for the over-consumption of natural resources, such as fuel, a few children could associate the impact of excessive use of cars and buses with the economic dimension of sustainability. This shows that some children can relate environmental, social and economic sustainability issues to each other, and, to some extent, can describe how they impact each other. It seems as though preschool children in Sweden may become environmentally aware at an earlier age than was reported by Kingham and Donohoe (2002). Their study (Kingham & Donohoe, 2002) on the perceptions of transport use in England found that children had no environmental awareness before ten years of age. One possible explanation for the differences between these two studies could be that the general awareness about environmental issues has increased globally over the past decade. Another reason could be that the Swedish National Curriculum for the Preschool (Skolverket, 2011), which explicitly addresses environmental issues, makes a difference in early childhood education, and therefore may have an effect on children’s comprehension of such issues.

It was noted that children in my study tended to describe environmental, social and economic issues in relation to their personal likes and dislikes. Their expressions were frequently mixed with a sense of responsibility towards Earth and all living creatures. With respect to the economic situation of the beggars in Sweden, they suggested that people should help the poor. Similarly, when talking about the environmental impact of various modes of transport, many children described how cycling is good for the environment since it does not lead to the emission of harmful gas, adding that they liked cycling. This trend was also noticed in Alerby’s (2000) study, where children frequently described environmental issues as being either good or bad for the world, and that they shared their ideas about what to do to protect the environment. For children, this could be a way of sharing their opinions and demonstrating their eagerness to act for a sustainable society.

**Preschool- and home-related factors and children’s learning for sustainability**

In general, my study showed a positive relationship between children’s declarative knowledge (understanding) of sustainability and preschool-
related factors, such as children’s discussions with teachers, their involvement in recycling activities with teachers, and the priority the preschools give to EfS in their educational work. However, children’s functioning knowledge (practice) was found to be negatively associated with discussions with teachers but positively associated with their participation in activities, such as children’s visits to recycling stations with teachers, and the scope and magnitude of sorting items at the preschool. These findings give rise to questions concerning pedagogical practices, of which two are:

1. Why did teachers’ sustainability-related discussions with children not contribute to improving children’s sustainability-related practices?
2. What consequences may these findings have on teaching and learning about sustainability at preschool?

There are several possible answers to the first question. For example, young children learn more practical things by participating in practical activities than they do from theoretical discussions, which is supported by the findings in my study as well as by Bruner (1960). Another possible answer, which is not necessarily mutually exclusive, is that children do not always find discussions very interesting and therefore do not pay much attention to what the teachers are saying. Yet another possible explanation is that discussions give children abstract knowledge about people and the planet, which can be difficult to put into practice. With regards to the second question, an answer could be that preschool children need to have opportunities to learn from both practical demonstrations and participation in practical activities.

According to Bandura’s (1977) social learning theory, children often learn by observing others in a social context. It may therefore be argued that children develop their sustainability-related behaviors when they see others performing similar activities. Previous studies have reported that children, with support and guidance from their teachers, learned about local and global issues through conversation and through involvement in activities related to sustainability (Davis 2005; Lewis et al., 2010; Mackey, 2012). As children’s learning results from explicit teacher instruction and direct participation (Corsaro et al., 2002), preschools need to include activities that engage children in education for sustainability as agents of change along with education in and about sustainability.

Tables 6 and 7 indicate some differences between mothers’ and fathers’ influences on children’s knowledge and practices of sustainability in terms of their discussions and involvement concerning EfS with their children. This finding resembles that of research reported by Sigel, Stinson, and Flaugher (1991), who found that mothers’ and fathers’ beliefs and behaviors had different effects on their children’s beliefs and behaviors. As my study was not designed to investigate such differences, future studies may explore the extent of these differences and the reasons for them as a way to arrive at
strategies that will serve to enhance children’s declarative and—in particular—functional recycling knowledge.

Interestingly, as shown in Table 7, the more parents themselves sorted items at home, assumingly without involving their children, the less practical knowledge about recycling the children had. Although it could be argued that the children would have learned from the adults by observing them sorting the waste, an alternative explanation could be that the more extensive the recycling, the less time the adults may feel they have for involving the children, who might then focus on other activities rather than watching the adults. In fact, Musser and Diamond (1999), who studied the pattern of relationships between child and parent using the CATES-PV scale, found that children’s attitudes did not correlate with their parents’ verbal communication; rather, they were associated with the extent to which the children participated in environmental activities at home. The results of my study underscore the importance of involving children in discussions and, even more importantly, in activities related to sustainability issues, both at home and at preschool.

**Comparisons between eco-certified and non-eco-certified preschools**

The results of my study did not show any statistically significant differences between eco-certified and non-eco-certified preschools in terms of children’s knowledge and practices related to *economic equality, resource sharing, recycling* and *transport use*. No comparative studies have been carried out in the field of early childhood education in Sweden to investigate whether eco-certification plays a role in developing preschool children’s knowledge, attitudes and practices regarding environmental, social and economic aspects of sustainability. However, a couple of studies with older children have investigated the outcomes of eco-certification of schools presenting similar or mixed results. One study that explored the perceptions of the learning experiences related to EfS among 209 ten- to twelve-year-old children did not identify any significant differences between four eco-certified and two non-eco-certified schools (Manni, Ottander, Sporre, & Parchmann, 2013). The other study was nationwide and measured sustainability consciousness among 1,773 students from 6th and 9th grades in Sweden. It found a positive but small association with eco-certified schools among students in grade six, while the association was negative among students in grade nine (Olsson, Gericke, & Chang Rundgren, 2015). It would have been valuable to know whether or not the participants in Olsson and his colleagues’ (2015) study had attended a preschool that had worked explicitly with environmental and sustainability issues, since we know that what
children learn when they are young tends to remain in their minds (Hofstede et al., 2010).

To determine whether eco-certification programs are beneficial for developing preschool children’s knowledge, attitudes and practices in a country where EfS is integrated in the national preschool curriculum, it is necessary to conduct a nationwide study of sufficient statistical power, not only among preschool children but also among older age groups. Conducting this type of study would involve the development of a valid and reliable instrument that is appropriate for children of various ages. From my own experience from this study, I would recommend that such an instrument be administered by trained enumerators, at least among younger children.

Globally, there is a lack of research on and evaluations of the effectiveness of EfS programs in whole-school sustainability programs (Henderson & Tilbury, 2004), despite the Decade of Education for Sustainable Development (DESD), which ended in 2014, calling for them. The Education 2030 Framework for Action reiterates this call for countries to evaluate the effect of education policies at the national level. The reason for this is to monitor achievements of the Education 2030 targets and to build policies “on monitoring results and research findings to ensure effective evidence-based decisions and results-oriented programs” (UNESCO, 2015, p. 38). Although Sweden is well-known for promoting EfS, no national-level study has yet been carried out to examine the impact of the policies in relation to practice. This knowledge is critical for policymakers and teachers to determine whether eco-certification has any role to play in developing preschool children’s knowledge and practices of sustainability.

Using content analysis of individual children’s responses, my study examined the differences between eco-certified and non-eco-certified preschools in terms of the quality of children’s responses on economic equality, resource sharing, recycling and transport use, applying the SOLO Taxonomy. Although the SOLO scores of the children at eco-certified preschools tended to be higher compared with those at non-eco-certified preschools, there were no statistically significant differences. One reason for this may be that the sample size did not allow for the detection of small differences. Previous case studies have reported that children who participated in whole-school programs, such as eco-schools or schools that promote a healthy lifestyle, had a deeper understanding of these issues, and had learned about global and local issues related to sustainability with help from teachers and adults (Davis, 2005; Davison, Davison, Reed, Halden, & Dillon, 2003; Lewis et al., 2010; Mackey, 2012).
Children’s sources of knowledge about sustainability

Generally, the findings on children’s self-reported sources of knowledge of sustainability showed that they perceived themselves to have learned a great deal through their parents, through personal contacts with people, through their teachers, through siblings and friends, and through various media. This supports the claim that children's learning is influenced by several role models within society (Bandura, 1977; Corsaro et al., 2002) and that “learning is rarely a result of a single experience” (Palmer et al., 1996, p. 326). Although most of the children mentioned others as being their sources of knowledge, some of them referred to themselves as being one source of knowledge. The children in Prince’s (2010) study also reported themselves as being the main source of knowledge, which supports the view that young children probably develop a sort of sense of themselves as being a source of knowledge. It could be that they might not have developed an awareness of the roles of others in their learning.

Several children in my study reported that they learned about economic inequality through observation in real-life situations or knew about it through family members, rather than learning about it in preschool. Likewise, Breiting and Wickenberg (2010, p. 18) argue that EfS takes place “outside school – in the family, among and in peer youth groups, in the local community itself, in society in a broader sense”. The children’s self-reported sources of knowledge indicate that EfS does take place in preschool, but that it also includes learning from family members, friends and other sources. According to Bandura (1977), the increase in TV, films and other visual media that provide symbolic modeling may reduce the importance of parents, teachers and other traditional role models in social learning. However, forty years later, children in my study still reported parents – along with teachers – as being their principal sources of knowledge, even though many of them probably have nearly unlimited access to various media. Thus, appropriate strategies for integrating role models in EfS are needed, as they can be instrumental for children’s learning for sustainability.

Methods discussion

Although the mixed methods approach is still considered to be a new paradigm within my field of study, I found it to be enriching and appropriate for addressing my research questions. The quantitative approach provided a general picture of children’s knowledge and practices of sustainability. It facilitated the investigation of relationships between preschool- and home-related factors with children's learning for sustainability. This was complemented by the qualitative approach, which offered flexibility in collecting data from children, such as asking questions in different ways, using synonyms, using child language and allowing children to think aloud.
or ask questions. The utilization of a qualitative approach for collecting and analyzing data provided an understanding of the phenomenon of children's ideas and thoughts. Applying a mixed methods approach, however, can be challenging as it requires skills, resources and time to collect and analyze data using both approaches.

The development of thematically connected semi-structured interview guides and questionnaires helped in the exploration of potential relationships between preschool- and home-related factors, and children's knowledge and practices of economic equality, resource sharing, recycling and transport use. The only instrument that was found to have been used in previous studies (Grodzieska-Jurczak et al., 2006; Musser & Diamond, 1999) was CATES-PV scale. Although the CATES-PV scale is a reliable and valid measurement tool with which to determine preschool children’s pro-environmental attitudes and behaviors, it was not of direct relevance to my study as it does not assess knowledge and practices concerning the environmental, social and economic dimensions of sustainability.

For coding, assessing and classifying children’s open-ended responses concerning economic equality, resource sharing, recycling and transport use, the adaptation of the SOLO Taxonomy for young children was found to be very useful. The experiences from my study suggest that the SOLO Taxonomy can be applied as an analytical tool in a wide variety of topics. The use of the SOLO Taxonomy can facilitate the coding of qualitative data at the individual level, which can then be used for quantitative analysis at the group level.

The use of illustrations for each theme, a sitting mat with pictures of puppies, a soft puppet and the play-based recycling activities were helpful in creating a friendly and playful atmosphere during the interviews with children. This is in line with findings from a literature review on how to listen to and involve young children in research, which reported that such artefacts were useful (Clark, 2007). During the interviews, some children seemed to be more interested in playing with the toys, looking at the illustrations and asking me questions about the puppet than they were in answering my questions. Moreover, some of the children wanted to bring their friends into the room to show them the toys and illustrations. As a consequence, I had to stay longer at some preschools so that the children could play with the artefacts. Despite the benefits of interviewing young children using different artefacts, it can be time-consuming, as the researcher may need to play with the children and tell them about the artefacts. Although this requires patience on the part of the researcher, it provides an enjoyable and playful environment for interviews, as Kyronlampi-Kylmanen and Maatta (2011) also have noted.

Similar to some studies included in an earlier review (Clark, 2007), I found audio-recording very useful while interviewing the children. It enabled
me to interact and play with the children without having to take notes at the same time, which helped the conversations flow smoothly without interruption while allowing for a playful interview situation. The audio-recording also enabled me to listen to children’s responses several times and to transcribe them as needed. Taking notes during interviews with young children makes it difficult to create a playful and friendly atmosphere, as taking notes may interrupt conversations between the child and the researcher.

My study has some limitations in the sampling of the preschools. The number of eco-certified preschools in Sweden is still small and not every municipality has one. Therefore, purposeful selection of preschools was considered appropriate in order to include equal numbers of eco-certified and non-eco-certified preschools from the same municipalities in towns and cities of various sizes. However, fewer children from non-eco-certified preschools participated in the study since 23.1% of the guardians of children at selected non-eco-certified preschools consented to their children’s participation, while that proportion was 46.9% at eco-certified preschools. The reason for receiving fewer consents from guardians of children at eco-certified preschool is not known. It could relate to guardians’ motivation and commitment to sustainable development issues, but it could also be that the information about the study was not passed on from all preschools to the guardians as planned. During the data-collection process, it became apparent that information letters given to one of the non-eco-certified preschools had not been distributed to guardians in due time, which resulted in less participation of children and their guardians from that preschool. It should also be noted that one of the participating non-eco-certified preschools had already started integrating EfS before the data were collected, and during the data collection process they received the Green Flag award. As this preschool had been working with EfS for some time before the study, it may have influenced the data in relation to children’s knowledge and practices at non-eco-certified preschools.

Considering the limitations of this study, caution is warranted when interpreting and generalizing the findings.
Conclusions and implications

In summary, the results show that by the time the children completed preschool, many had gained some knowledge about the lives of other children in the world, and about the impact of different modes of transport on the environment and on people’s lives. Further, a large majority of the children had acquired practical knowledge about how to sort objects. Many of them were willing to share resources (candies) with friends, and some of them wanted to donate money to parents, siblings and poor people.

A major finding is the significant and positive relationship between preschool children’s learning for sustainability and their involvement with teachers and parents in sustainability-related discussions and practices. Verbal interactions seemed to have a greater positive association with children’s declarative (understanding) knowledge than their functioning (practical) knowledge. Likewise, directors’ and teachers’ perceived high value of EfS issues was positively associated with children’s declarative knowledge and, to a lesser extent, with their functioning knowledge.

This study did not find any statistically significant differences between eco-certified and non-eco-certified preschools in terms of children’s knowledge and practices of the four studied themes: economic equality, resource sharing, recycling and transport use. Even though children at eco-certified preschools tended to show deeper knowledge according to the SOLO Taxonomy scores as compared with those at non-eco-certified preschools, these differences were not statistically significant.

Although parents were reported to be the main source of knowledge of environmental and sustainability-related issues, the children also perceived their teachers, siblings, TV/books and they themselves as sources of knowledge.

As outlined below, this study has possible implications for pedagogical practices at preschool and home, and for teacher education and future research.

- Since children are capable of engaging in issues related to the environmental, social and economic dimensions of sustainability, they need to be given the opportunity both at preschool and at home to participate in discussions and practical activities that concern their lives.
- The empirical knowledge produced by this research may be used in teacher education programs to develop evidence-based pedagogical practices for addressing EfS in Sweden as well as globally.
- In order to develop effective pedagogical practices, further research is needed to evaluate the extent to which different educational activities contribute to developing children’s understanding and behavior in terms of a sustainable society.
To investigate whether eco-certification programs have any beneficial role to play in developing children’s knowledge, attitudes and practices of sustainability, and whether associated costs are justified, particularly in a country where the national preschool curriculum already addresses sustainability issues, there is a need for a nationally representative study in Sweden.

The overall aim of this study was to contribute insight into preschool children’s self-reported knowledge, practices and sources of knowledge in terms of economic equality, resource sharing, recycling and transport use in Sweden. In order to contribute to making our society sustainable, it is important to enhance our knowledge about what children know and practice, and how they gain their knowledge. In this regard, my study has shown that there is a significant relationship between children’s learning for sustainability and preschool- and home-related factors. This knowledge can be used to develop educational policies about EfS at preschools, as well as to develop pedagogical practices and learning in social settings.

Children as agents of change need to be aware of their one and only home – the planet Earth – so that they can make it a better place for themselves and all other living creatures. As early-year learning impacts people’s knowledge, attitudes, values and behaviors, the integration of sustainability in early childhood education can make a meaningful difference in building a future sustainable society.
Sammanfattning på svenska

Bakgrund och syfte


Det övergripande syftet med denna studie har varit att öka kunskapen om förskolebarns lärande för hållbarhet i Sverige. Studien har undersökt förskolebarns egenrapporterade kunskaper och praktiska färdigheter vad

Denna studie definierar inte termen "kunskap"; snarare används termen för att beskriva barns egenrapporterade kunskap genom verbala svar och praktiska handlingar. Begreppet "kunskap" i denna text ska förstås som barnens egna beskrivningar av sina föreställningar och tankar. Egenrapporterade handlingar avser barns egna beskrivningar av vad de gör och hur de utför olika aktiviteter på förskolan, i hemmet eller när de är med vänner och ska hållas isär från observationer av barns agerande.

I denna studie kategoriseras förskolor som har fått utmärkelsen Skola för hållbar utveckling eller har Grön flagg-certifikat som ekocertifierade förskolor.

**Metoder**


Både kvalitativa och kvantitativa data samlades in under perioden februari till september 2015. Data samlades in från tolv olika förskolor varav sex var ekocertifierade. Förskolorna fanns i sex kommuner i två län i Sverige. Data om förskolebarnens kunskaper om och praktiska färdigheter vad gäller hållbar utveckling samlades in genom intervjuer och observationer av 53 barn som gick sitt sista år på förskola. Vidare besvarade 74 förskolepedagoger och 89 vårdnadshavare enkäter, och sju förskolechefer som var ansvariga för de inkluderade förskolorna intervjuades.

Den regionala etikprövningsnämnden i Umeå hade inte några invändningar mot studiens upplägg som följer Vetenskapsrådets etiska riktlinjer. Data samlades in efter informerat samtycke från förskolechefer, deltagande pedagoger samt deltagande barn och deras föräldrar.

**Resultat och slutsatser**

Resultaten visar att många barn i förskolans sista år hade förvärvat viss kunskap om hur man använder pengar, om sortering av olika återvinningsartiklar hemma och i förskolan och om påverkan av olika transportsätt på miljön samt om människors hälsa och välfärd. De hade
också viss uppfattning om hur livet ser ut för andra barn i världen och vad det kan innebära att dela med sig av resurser till andra människor.

Det fanns ett positivt samband mellan barns deklarativa kunskaper (förståelse) och funktionella kunskaper (praktik) om hållbarhetsfrågor, samt lärarnas och vårdnadshavarnas deltagande i hållbarhetsrelaterade diskussioner och aktiviteter. Inga statistiskt signifikanta skillnader kunde påvisas mellan ekocertifierade och icke-ekocertifierade förskolor i form av barns deklarativa och funktionella kunskaper. Föräldrar rapporterades vara de viktigaste källorna till barnens kunskap tillsammans med lärare och TV. Flera barn uppgav också att deras kunskap kom från dem själva.

Resultaten ger stöd för att integrera miljömässiga, sociala och ekonomiska dimensioner av hållbar utveckling i förskolans dagliga pedagogiska verksamhet. I studien framträdde betydelsen av att barn ges möjlighet att delta inte bara i diskussioner utan också i praktiska aktiviteter som berör deras liv för vilken kunskap de utvecklar om hållbarhetsfrågor.

Ytterligare studier behövs för att undersöka i vilken utsträckning olika utbildningsaktiviteter bidrar till att utveckla barns förståelse och beteende när det gäller ett hållbart samhälle samt hur man kan engagera dem på ett meningsfullt sätt i deras lärande för hållbarhet.
Acknowledgements

During my time as a doctoral candidate, I have been fortunate to come in contact with people from around the world, people who have been generous and supportive with regards to my research. I apologize for being unable to thank each and every one by name here.

First and foremost, I would like to thank my principal supervisor, Prof. Monika Vinterek, for her tremendous support at each step. I gratefully acknowledge her patience, skillful guidance, wealth of knowledge and encouragement. We have had many discussions from which I have benefitted greatly. Monika, you have positively enriched my dissertation experience with your professional guidance and support. I have learned a lot from you.

I would also like to express my sincere gratitude to my co-supervisor, Asst. Prof. T. Mikael Winberg, for his continuous support, constructive criticism, encouragement and guidance. I have learned a great deal from you, Mikael. Working with you opened the door to a new horizon. I highly appreciate the time you spent teaching me about statistics, which has been very useful for this study. Both Monika and Mikael are the best supervisors one could ever wish for.

I am grateful to all participating children for sharing their ideas, thoughts, explanations and experiences. Without their authentic contributions, this study would be empty. I would like to thank all parents and guardians who consented to their children’s participation and who took time completing the questionnaire. Further, I would like to acknowledge the support of all the preschool directors who allowed me to attend the preschools and who gave me the opportunity to interview them. I highly appreciate the cooperation and responses of all preschool teachers and child attendants who made this study possible.

I gratefully acknowledge the generous support of Prof. John Biggs for responding to all my questions related to the SOLO Taxonomy. I am also very grateful to Pam Hook for her guidance in incorporating the SOLO Taxonomy as an analytical tool for young children for my study. Moreover, I want to extend my sincere gratitude to Prof. Ingrid Pramling Samuelsson, Prof. Karin Sporre and Prof. Nafsika Alexiadou for their valuable support at the different stages of my study.

I would also like to thank Bodil Sundberg and Gunilla Lindqvist for their useful comments and suggestions during my 90-percent seminar. I am also grateful to Annie-Maj Johansson, who read and commented on my texts at the half-time seminar. In addition, I am indebted to Prof. Maria Olson for her valuable comments on the theoretical and conceptual framework, and Prof. Sara Irisdotter Aldenmyr for her suggestions during the development of interview questions for children. I would further like to thank Kenneth
Ekström for his support as co-supervisor during my first year. My sincere gratitude to Ulf Lundström for his continuous support.

I would like to acknowledge the contribution of the Post-Graduate School for Educational Sciences at Umeå University for the courses in Umeå, in Brighton, in Oslo and in Trondheim. My sincere gratitude to Prof. Geir Afdal of the Research School of Religion Values Society. It was an enriching experience to be a member of the School and to attend the course in Lesvos.

It is not possible to complete a dissertation without the support and inspiration of friends and colleagues. I would, therefore, like to extend my gratitude to Maria Olsson, Anders Norberg, Barbara Kolucki, Alison Holden-Nyström, Helene Rocking-Johansson, Margareta Litsmark, Tarja Alatalo, Marie Frykholm, Maria Fredriksson, Maryam Bourbour, Anna Hagberg and Anna Rantala for their encouragement throughout this journey.

I would like to thank Mats Tegmark for always being kind, positive and generous. My sincere thanks to Peter Gabrielsson for his administrative support and great interest in my research. I would also like to acknowledge the support I received from the librarians at Dalarna University all through my doctoral study. My special thanks to Mandy Bengts for efficient work with checking the language in papers and the dissertation. I am also grateful to Pauline Borg, who did most of the illustrations for this dissertation, and Silvia Wiklund, who helped me take the cover photo.

At this time, my thoughts go back to my beloved parents, the Late Asiya Begum and the Late Nazibar Rahman, who have always been the inspiration behind my education and my life. I would like to express my deep gratitude to my brother Atiqur and my sisters Chamely, Molly, Shelly, Alice, Wahida and Sara and their spouses and children. You have always been a great support for me, and you are the best siblings in the world. I especially acknowledge the valuable comments and suggestions I received from my loving sister Wahida and her husband David to improve the quality of my dissertation.

Last but not least, I would like to thank my beloved husband and research partner Johan for his whole-hearted support, inspiration, assistance and, most of all, patience throughout these years. I have learned a lot from you about how to work systematically. You deserve my gratitude more than anyone else. From the depth of my heart, I would like to thank our very dear children Joseph, Jonathan and Joshua for their love and care. I am grateful that you have never complained about my absence or long working hours. You are the most valuable gifts in my life.

Rättvik 2017
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Appendix A: Letter to directors

Ärende: Deltagande i forskning om Lärande för hållbar utveckling i förskolan


Rent konkret går studien till på följande sätt under Vt 2015 (XX):


2. Förskollärare, barnskötare och föräldrar får svara på skriftliga enkäter, vilket tar ungefär 15-20 minuter.

3. Förskolechef intervjuas av mig utifrån en enkät, vilket tar ungefär 20-30 minuter.

Intervjun kommer att ske med ljudspelning efter medgivande av deltagande Förskolechef. Studien följer Vetenskapsrådets forskningsetiska riktlinjer. Allt deltagan- de är frivilligt och kan avbrytas när som helst. Alla namn kommer att vara konfidentiella och i rapporteringen kommer påhittade namn användas.

Inom kort kommer jag att kontakta dig. Om du har några frågor kring studien innan dess kan du nå mig på telefon 023-XX eller 070-XX samt på e-postadress XX. Du kan även kontakta min handledare professor Monika Vinterek på telefon 023-XX eller på e-postadress XX.

Vänliga hälsningar

Farhana Borg
Appendix B: Letter to guardians

Till vårdnadshavare och barn!


I studien ingår intervjuer av barn som går sitt sista år i förskolan. Anledningen till att ni får det här brevet är att vårdnadshavare behöver ge sitt medgivande för intervjuer av barn. Vi skulle också vilja ställa några frågor till dig som vårdnadshavare genom en enkät.

Studien handlar om förskolebarns förståelse och praktiserande av hållbar utveckling. Hållbar utveckling handlar om hur människor kan leva i harmoni med varandra och naturen. Studien kan bli till nytta för att utveckla det pedagogiska arbetet kring dessa frågor. Resultatet kommer att redovisas i en doktorsavhandling, i vetenskapliga artiklar och på konferenser.


Om barnet vill delta i denna studie och du/ni ger din/er tillåtelse ber jag dig/er underteckna bifogat medgivande på omstående sida. Det extra informationsbrevet kan du/ni behålla. Om du/ni gett ditt/ert medgivande kommer barnet att tillfrågas i närvaro av förskolans personal innan intervjun påbörjas. Barnets vilja att delta eller inte delta kommer att respekteras.


Om du/ni väljer att delta i studien stoppar du/ni ifyllt medgivande och ifylld(a) enkät(er) i det förrfrankerade kuvertet. Posta kuvertet senast XX.

Vill du/ni veta mer om studien eller undrar om något är du varmt välkommen att kontakta mig på telefon 023-XX eller 070-XX eller på e-postadress XX. Du kan även kontakta professor Monika Vinterek på telefon 023-XX eller på e-postadress XX.

Vänliga hälsningar

Farhana Borg
Appendix C: Letter to teachers

Till förskollärare/barnskötare!

Ärende: Informationsbrev om enkätundersökning om Lärande för hållbar utveckling i förskolan


Anledningen till att du får det här brevet är att jag skulle vilja att du som är lärare/-barnskötare vid den här förskolan deltar i studien. Att svara på enkäten tar ungefär 15-20 minuter.

Studien handlar om förskolebarns förståelse och praktiserande av hållbar utveckling. Hållbar utveckling handlar om hur människor kan leva i harmoni med varandra och naturen. Studien kan bli till nytta för att utveckla det pedagogiska arbetet kring dessa frågor. Resultatet kommer att redovisas i en doktorsavhandling, i vetenskapliga artiklar och på konferenser.

Studien följer Vetenskapsrådets forskningsetiska riktlinjer. Allt deltagande är frivilligt och kan avbrytas när som helst. Alla namn kommer att vara konfidentiella och i rapporteringen kommer påhittade namn användas.

Om du vill delta i studien ber jag att du fyll i den bifogade enkäten och stoppa den sedan i det medföljande förfrankerade kuvertet och posta det senast XX.

Om du har några frågor kring studien kan du nå mig på telefon 023-XX eller 070-XX samt på e-postadress XX. Du kan även kontakta professor Monika Vinterek på telefon 023-XX eller på e-postadress XX.

Vänliga hälsningar

Farhana Borg
# Appendix D: Interview instrument for children

## Participant

<table>
<thead>
<tr>
<th>Child’s name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit:</td>
</tr>
<tr>
<td>Preschool:</td>
</tr>
<tr>
<td>Municipality:</td>
</tr>
</tbody>
</table>

## Interview information

<table>
<thead>
<tr>
<th>Date:</th>
<th>Interview start at:</th>
<th>Interview complete at:</th>
<th>Total time (minutes):</th>
</tr>
</thead>
</table>

Interview status:
- [ ] Completed
- [ ] Partly completed. Reason: 
- [ ] Not started. Reason: 

With audio recording: [ ] Yes: [ ] Whole interview [ ] Partly
- [ ] No

Interviewed by: 

## Background information

1. Child’s age:
   - [ ] 5 years
   - [ ] Other: 

2. Sex:
   - [ ] Girl
   - [ ] Boy

## THEME: ECONOMIC EQUALITY

3. Kim is curious to know if all children in the world can afford (have money) to buy toys from a shop.
   - [ ] Yes
   - [ ] Maybe
   - [ ] No
   - [ ] I don’t know
   - [ ] Other: 


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4. Why do you think that all children [can/cannot/may not be able to] afford to buy toys from a shop?

5. From where have you learned about this?
   - From preschool/teachers
   - From guardians
   - From siblings
   - From friends
   - From TV/video/film
   - From books/magazines
   - Don’t know
   - Other:

**THEME: RESOURCE SHARING**

6. Kim would like to know what you would do with your money if you had some.

7. If you had a bowl of candies and your friend came and wanted to have some candies from you, what would you do?
   - If yes, how much would you like to give?
     - I would give all the candies = 3
     - I would give about half of the candies = 2
     - I would give a few or very few candies = 1
     - I would not give any candies = 0
     - Other:

8. Why would you [share or not share]?

9. From where have you learned to share or not share?
   - From preschool/teachers
   - From guardians
   - From siblings
   - From friends
   - From TV/video/film
   - From books/magazines
   - Don’t know
   - Other:
THEME: RECYCLING

Would you please help me to sort these items: a banana peel, a cola can and a plastic bottle? You can see that there are three boxes: one is for composting, one is for the disposal of waste, and the other one is for bottle recycling.

10. Recycling function correctness:
   - Recycled all items correctly = 3
   - Recycled two items correctly and one item incorrectly = 2
   - Recycled one item correctly and two items incorrectly = 1
   - Recycled all items incorrectly = 0

11. Why have you sorted the items for recycling [child’s recycling action] in this way?

12. What do you usually do with the can or bottle when you have drunk pop, for example?
   - I don’t know
   - I don’t drink pop
   - I throw it
   - I keep it for recycling/I recycle it
   - I play with it
   - Other: _______________

13. Do you sort anything at your preschool? □ Yes □ No

14. If yes, what do you sort?
   - Paper □ Cardboard □ Newspaper □ Books □ Pens □ Toys □ Lamps □ Batteries
   - Metal □ Food □ Plastic bags □ Bottles □ Cans □ Clothes □ Other: __________

15. Do you sort anything at home? □ Yes □ No

16. If yes, what do you sort?
   - Paper □ Cardboard □ Newspaper □ Books □ Pens □ Toys □ Lamps □ Batteries
   - Metal □ Food □ Plastic bags □ Bottles □ Cans □ Clothes □ Other: __________

17. From where have you learned to sort?
   - From preschool/teachers
   - From guardians
   - From siblings
   - From friends
   - From TV/video/film
   - From books/magazines
   - Don’t know
   - Other: _______________
18. Would you like to tell Kim (puppet) what environment (miljö) or nature (natur) is?

19. Kim says that I live close to my preschool (daycare center). Sometimes I walk to my preschool with my mom or with my dad or with someone else. Sometimes we go by bicycle and sometimes they drive me to preschool by car.

<table>
<thead>
<tr>
<th>How good is it [for environment/nature/trees, flowers, birds, animals or people] if someone who lives close to the preschool goes to preschool?</th>
<th>Very good</th>
<th>Good</th>
<th>Quite good</th>
<th>Bad</th>
<th>Don't know</th>
</tr>
</thead>
<tbody>
<tr>
<td>20. by bicycle</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. on foot</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. by car</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. by bus</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

24. Why is going by [transport mode] [response option selected by child] for the [environment] if someone lives close to the preschool?

25. From where have you learned about [child’s response]?

- From preschool/teachers
- From guardians
- From siblings
- From friends

- From TV/video/film
- From books/magazines
- Own idea
- Other:
# Appendix E: Questionnaire for guardians

**Questionnaire – Guardians**

Caring for People and the Planet: Preschool Children’s Knowledge and Practices of Sustainability

## Part I

**Please answer the following questions.**

<table>
<thead>
<tr>
<th>Question</th>
<th>Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the name of the preschool that the participating child attends?</td>
<td></td>
</tr>
<tr>
<td>2. Sex:</td>
<td>Woman □  Man □</td>
</tr>
<tr>
<td>3. Which age group do you belong to?</td>
<td>20 years or below □  30-39 years □  40 years or above □</td>
</tr>
<tr>
<td>4. What is your profession?</td>
<td></td>
</tr>
<tr>
<td>5. Where do you live?</td>
<td>Town □  Small city □  Large city □</td>
</tr>
<tr>
<td>6. What is the highest level of your education?</td>
<td>Compulsory □  Upper secondary □  Folk high school □  University □  Other (please mention):</td>
</tr>
<tr>
<td>7. Does your household own a car?</td>
<td>Yes □  No □</td>
</tr>
<tr>
<td>8. How often do you use public transport (i.e. bus or train)?</td>
<td>Every day □  A few times each week □  A few times each month □  A few times each year □  Never</td>
</tr>
<tr>
<td>9. How often do you sort recyclable items at home?</td>
<td>Every day □  A few times each week □  A few times each month □  A few times each year □  Never</td>
</tr>
<tr>
<td>10. How often does your child sort recyclable items at home?</td>
<td>Every day □  A few times each week □  A few times each month □  A few times each year □  Never</td>
</tr>
<tr>
<td>11. Of the following items, which do you sort at home? (You can choose more than one alternative.)</td>
<td>Paper □  Cardboard □  Newspaper □  Lamps □  Batteries □  Metal □  Food □  Plastic □  Bottles/cans</td>
</tr>
<tr>
<td>12. How often do you visit the recycling station with the child?</td>
<td>Every day □  A few times each week □  A few times each month □  A few times each year □  Never</td>
</tr>
<tr>
<td>13. What do you do with toys that are in good condition but the child does not play with? (You can choose more than one alternative.)</td>
<td>Sell □  Give away □  Save it for younger siblings □  Save it until the child grows older □  Throw □  Leave in toy box/cupboard □  Other (please explain):</td>
</tr>
</tbody>
</table>
### PART II

How often do you discuss the following questions with the child who is participating in the study?

<table>
<thead>
<tr>
<th>Question</th>
<th>Every day</th>
<th>A few times each week</th>
<th>A few times each year</th>
<th>Never</th>
<th>A few times each month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Travelling together to work/preschool</td>
<td></td>
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</tr>
<tr>
<td>2. The impact of transportation on the environment</td>
<td></td>
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</tr>
<tr>
<td>3. Reusing of different materials, i.e. paper, cardboard, food, bottles and cans</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Recycling of things that you or others have used</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Donating or selling used clothes</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Buying of secondhand clothes, shoes or toys</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7. The situation of children in other countries</td>
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<tr>
<td>8. Sharing things with others</td>
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<tr>
<td>9. Economy or money</td>
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<tr>
<td>10. Child’s satisfaction preschool</td>
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<tr>
<td>11. Abusive treatment or mobbing at preschool</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>12. Conflict-solving in daily situations</td>
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</tr>
</tbody>
</table>
Appendix F: Questionnaire for teachers

<table>
<thead>
<tr>
<th>1. Preschool's name:</th>
<th>ID nr:</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Unit:</td>
<td></td>
</tr>
<tr>
<td>3. Municipality:</td>
<td></td>
</tr>
</tbody>
</table>

**PART II Background information**

1. What is your profession? □ Preschool teacher □ Child attendant □ Other:

2. Sex: □ Woman □ Man

3. What age group do you belong to? □ 18-20 years □ 21-40 years □ 41-60 years □ 61-65 years □ 66 years or above

4. How long have you worked at preschools? □ 0-1 year □ 2-5 years □ 6-10 years □ 11-20 years □ 21 years or above

5. What is your highest education level? □ Compulsory □ Upper secondary child attendant □ Upper secondary – not child attendant □ Preschool teacher □ Compulsory education teacher □ Special education at university □ Recreational activity leader □ Other (please explain):

6. Have you taken any courses or training on sustainable development? □ No □ Yes. Please describe the education or training on sustainable development that you have taken:

**PART III Work with the environment and sustainability**

1. What is your opinion about education for sustainability at preschool? □ Very important □ Important □ Quite important □ Not at all important □ Don’t know

2. Please motivate your response to question 1:

3. Do you sort recyclable objects at preschool together with the children? □ Every day □ A few times each week □ A few times each month □ A few times each year □ Never

4. Do you have trash cans at preschool where the children can sort different recycled items? □ Yes □ No

5. If you have responded yes to question 4, how would you describe the location of the containers where children can put materials for recycling? □ Accessible □ Inaccessible

6. What do you sort? (You can choose more than one alternative.) □ Paper □ Cardboard □ Newspaper □ Lamps □ Batteries □ Metal □ Food □ Plastic □ Bottles/cans

7. Do you visit the recycling station together with children? □ Every day □ A few times each week □ A few times each month □ A few times each year □ Never
PART IV Conversation about environment and sustainability

How often do you discuss the following issues with the children?

<table>
<thead>
<tr>
<th>Issue</th>
<th>Every day</th>
<th>A few times each week</th>
<th>A few times each year</th>
<th>Never</th>
<th>A few times each month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Travelling together to work/preschool</td>
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<td></td>
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<tr>
<td>2. Impact of transportation on the environment</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>3. Recycling of different materials, e.g., paper, cardboard, food, bottles and cans</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Recycling of things that you or others have used</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>5. Donating or selling used clothes</td>
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<td>7. The situation of children in other countries</td>
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<tr>
<td>10. Child’s satisfaction with the preschool</td>
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<tr>
<td>11. Abusive treatment or mobbing at preschool</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Conflict-solving in daily situations</td>
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</tr>
</tbody>
</table>
Appendix G: Interview instrument for directors

<table>
<thead>
<tr>
<th>Participant</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preschool’s name:</td>
</tr>
<tr>
<td>2. Municipality:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interview information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date:</td>
</tr>
<tr>
<td>Interview status:</td>
</tr>
<tr>
<td>☐ Completed</td>
</tr>
<tr>
<td>☐ Partially completed. Reason:</td>
</tr>
<tr>
<td>☐ Not started. Reason:</td>
</tr>
<tr>
<td>☐ Audio-recorded</td>
</tr>
<tr>
<td>Interviewed by:</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Background information</th>
</tr>
</thead>
<tbody>
<tr>
<td>4. Director:</td>
</tr>
<tr>
<td>☐ Female</td>
</tr>
<tr>
<td>☐ Male</td>
</tr>
<tr>
<td>5. Number of teachers (with teacher education, preschool teacher education or recreational pedagogical education) at the preschool:</td>
</tr>
<tr>
<td>6. Total number of child attendants at the preschool:</td>
</tr>
<tr>
<td>7. Total number of children at the preschool:</td>
</tr>
<tr>
<td>8. Certification of the preschool:</td>
</tr>
<tr>
<td>☐ Yes. Type of certification:</td>
</tr>
<tr>
<td>o Environmental certification, year:</td>
</tr>
<tr>
<td>o Green flag, year:</td>
</tr>
<tr>
<td>o Preschool for sustainable development, year:</td>
</tr>
<tr>
<td>o Other:</td>
</tr>
<tr>
<td>☐ No</td>
</tr>
<tr>
<td>9. Location of preschool:</td>
</tr>
<tr>
<td>☐ Town (12 000 inhabitants or less)</td>
</tr>
<tr>
<td>☐ Small city (more than 12 000 inhabitants)</td>
</tr>
<tr>
<td>☐ Big city (more than 500 000 inhabitants)</td>
</tr>
</tbody>
</table>

10. How important is it for you that preschool works with environmental and sustainability issues?
| ☐ Very important | | | |
| ☐ Important | | | |
| ☐ Quite important | | | |
| ☐ Not so important | | | |
| ☐ Not at all important | | | |
11. Please give reasons for your response to question 10:
________________________________________________________________________
________________________________________________________________________

12. What priority does the preschool give to work on the environment and sustainability?
☐ Very important
☐ Important
☐ Quite important
☐ Not so important
☐ Not at all important

12. Please give reasons for your response to question 12:
________________________________________________________________________
________________________________________________________________________
The following dissertations have been published in this series:


Today’s children hear about climate change and natural disasters, poverty and conflicts, inequality and other challenges of our world. This dissertation studies preschool children’s self-reported knowledge and practices regarding the environmental, social and economic dimensions of sustainability, and explores their relationships with factors at preschool and at home. Further, this study compares eco-certified and non-eco-certified preschools in terms of children’s knowledge and practices of sustainability. The results may contribute to developing pedagogical practices that can engage young children meaningfully for creating a sustainable future for people and the planet.

**Farhana Borg** works as a lecturer at the early childhood teacher education program at Dalarna University. She has been a doctoral candidate at the Department of Applied Educational Science at Umeå University in Sweden. She has long experience of working with child rights and early childhood care and development programs internationally, including at UNICEF.