

Discourse and Communication for Sustainable Education,
vol. 14, no. 1, pp. 112–136, 2023

Expert Teachers' Perceptions of Their Students' Environmental Literacy and the Practice of Environmental Education

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Abstract

Effective environmental education (EE) is urgent as climate change and environmental degradation are proceeding. More theoretical models to enhance the effectiveness of environmental education are constantly presented, but a comprehensive view from teachers' perspectives is absent. This paper presents unique results from expert ENO Schoolnet Association's (ENO) expert EE teacher group interviews from the World Summit of Students for Climate Event (WSSC). These educators represent over 40 nations. The group interviews explore the teachers' perceptions of their students' environmental literacy and teaching of EE. The data were analyzed with content analysis. The results point out that these expert EE teachers feel that most students fail to achieve operational environmental literacy. This paper examines the potential school-related and student-related barriers preventing this operational literacy. Furthermore, the EE provided by the teachers usually lacks behavioral literacy methods. At the same time, the teachers feel that these methods should be emphasized to ensure the effectiveness of EE. In the future, it would be useful to study environmental clubs' potential to overcome some of the barriers and promote pro-environmental actions.

Keywords: environmental literacy, environmental education, barriers, pro-environmental behavior, expert teachers, group interviews

Introduction

Environmental education (EE) aims to develop environmentally responsible citizens. This aim was already established in the 1970s by UNESCO (UNESCO, 1977). This aim is still often seen as the aim of EE (Chawla & Cushing, 2007; Hungerford & Volk, 1990). In recent decades, several EE and other researchers have published ideas for accomplishing the aim of EE (Cantell et al., 2019; Hungerford & Volk, 1990; Palmer, 1998). Moreover, models with other initial purposes, such as environmental policy actions, have also been utilized in EE (e.g., Koskinen & Paloniemi, 2010). Also, concluding reports on EE pathways have been published (e.g., Wheaton et al., 2018). With this intense focus on this matter, it is surprising that EE results are still weak as the most

people are unwilling to change their consumptive lifestyle (e.g., UNESCO, 2014; Salonen et al., 2018). The problem remains that students' pro-environmental attitudes do not often transfer to pro-environmental behavior despite the researchers' and teachers' efforts (e.g., Saylan & Blumstein, 2011). The failure of EE is a widely recognized problem, and enhancing behavioral change is an important research topic in the context of EE (Ardoin et al., 2013; Clark et al., 2020).

The formation of environmental behavior is complex, as the environmental concern is formed from the combination of internal factors that are tightly connected to a person and contextual factors that are influenced by the context around the person (Huoponen, 2023; Marquart-Pyatt, 2012). Internal factors can be, for example, age, gender, parents, and friends (e.g., Collado et al., 2019; Otto et al., 2019; Stevenson & Peterson, 2016). External factors can be, for example, political structures, legislation, economic incentives, environmental conditions, and media (e.g., Holbert et al., 2003; Huang, 2016; Marquart-Pyatt, 2012; Stern, 2000; Parzonko, 2021). However, the reason for the lack of environmental actions is highly controversial, and also, varying conceptions of the role of environmental knowledge, attitudes, emotions, and behavior has been given (e.g., Carmi et al., 2015; Frick et al., 2004; Jensen, 2002; Kaiser & Gutscher, 2003; Rees et al., 2015).

The concept of environmental literacy can be used to clarify concepts of knowledge, attitudes, and behavior and their relations (Fang, 2020). However, environmental literacy has recently received little attention under the pressure of the United Nation's Sustainable Development Goals (Fang, 2020). Environmental literacy includes environmental sensitivity, knowledge, skills, attitudes and values, personal investment, responsibility, and active involvement (Liu et al., 2015; Roth, 1992). In its simplest form, an environmentally literate person can be described as someone who shows awareness, concern, and understanding of environmental actions and who takes action to enhance the situation (Moseley, 2000).

Environmental literacy can be divided into three levels: nominal environmental literacy, functional environmental literacy, and operational environmental literacy (Roth, 1992; Fang, 2020). These categories may help to clarify real-life situations with people's environmental behavior. To define the level of students' environmental literacy on the literacy continuum, the state of environmental literacy must be observable, for example, in the form of knowledge and behavior (Roth, 1992). In this study, knowledge, concern, and behavior are used as key concepts to determine the stage of students' environmental literacy in the continuum (see Fang, 2020).

A person at the nominal level can recognize terms and develop awareness and sensitivity. A person at this level has basic environmental knowledge. A person at the functional level has more knowledge and a greater ability to understand nature. In addition, their ability to behave in an environmentally responsible manner and to communicate about environmental matters is more developed than that of those at the nominal level. A person with operational literacy has environmental attitudes and intentions to act. In the last phase, operational literacy represents a state in which a person can gather and synthesize knowledge and is willing and eager to enhance and protect the environment. A person at this stage has environmental knowledge and attitudes, which also materialize as pro-environmental behavior (Fang, 2020; Roth, 1992). Table 1 demonstrates how the environmental literacy continuum is used in this study based on the studies of Roth (1992) and Fang (2020). This study mainly focuses on knowledge, attitudes, and behavior,

as these are measurable. Previous studies also note that often a person is not illiterate or literate but something between these (Roth, 1992).

Table 1

An Environmental Literacy Continuum Based on the Studies of Roth (1992) and Fang (2020)

Nominal literacy	Functional literacy	Operational literacy
• Developing awareness and sensitivity • Developing concern • Fostering knowledge of how environmental systems work	• Knowledge and extensive understanding • Ability to synthesize and evaluate relevant information • Environmental attitudes and pro-environmental intentions	• Advanced environmental knowledge and skills • Ability and willingness to take action proactively • Environmental knowledge, environmental attitudes, and environmental behavior

Later studies have focused merely on the formation of environmental literacy (Hollweg et al., 2011; Liang et al., 2018). Based on these studies, the components of environmental literacy can be called, for example, domains or elements (Hollweg et al., 2011; Liang et al., 2018). Hollweg et al. (2011) describe environmental literacy as constructed by knowledge, disposition, and competencies that lead to environmentally responsible behavior via mediating and moderating contexts. These domains also influence each other. Similarly, Liang et al. (2018) describe environmental literacy as constructed by cognitive, affective, and behavioral elements. Furthermore, similarly to Hollweg et al. (2011), Liang et al. (2018) elaborate on the contents of these elements. These are described in more detail in Table 2. In the table, H symbolizes Hollweg et al. (2011), and L symbolizes Liang et al. (2018).

Table 2

Elements of Environmental Literacy, According to Hollweg et al., (2011) and Liang et al. (2018)

Elements	Hollweg et al., 2011	Liang et al., 2018
Knowledge (H) Cognitive (L)	What you know about: • Physical and ecological systems • Social, cultural, and political systems • Environmental issues • Multiple solutions to environmental issues • Citizen participation and action strategies	• Knowledge of natural systems • Knowledge of environmental issues • Knowledge of appropriate action strategies
Disposition (H) Affective (L)	How you respond to environmental issues: • Sensitivity • Attitudes and concern toward the environment • Assumption of personal responsibility • Locus of control/Self-efficacy • Motivation and intention to act	• Environmental awareness and sensitivity • Environmental values • Decision-making attitudes about environmental issues

See next page for continuation of table

Continuation of Table 2

Competencies (H)	Skills and abilities that you know how and when to apply:	• Intentions to act • Environmental actions strategies and skills • Involvement in responsible environmental behaviors
Behavioral (L)	• Identify environmental issues • Ask relevant questions about environmental conditions and issues • Analyze environmental issues • Investigate environmental issues (scientific and social aspects of issues using primary and secondary sources) • Evaluate and make personal judgments about environmental issues (the interaction between environmental conditions and sociopolitical systems) • Use evidence and knowledge to select and defend one's own position(s) to resolve issues • Create and evaluate plans at various scales/levels to resolve environmental issues	

The elements outlined by Hollweg et al. (2011) and Liang et al. (2018) share a lot of similarities. In particular, Hollweg et al. (2011) “knowledge” and Liang et al. (2018) “cognitive” are similar as well as Hollweg et al. (2011) “disposition” and Liang et al. (2018) “affective” share a lot of similarities. Lastly, also Hollweg et al. (2011) “competencies” and “behavioral” by Liang et al. (2018) are similar. These elements can be considered steps towards operational environmental literacy.

The data for this study were collected in the summer of 2019 at the World Summit of Students for the Climate (WSSC). In the event, 135 students and 100 teachers from 70 countries gathered to discuss climate change (WSSC 2019). The event was organized by the ENO Schoolnet Association (ENO). The ENO is a sustainable development network for schools and municipalities. ENO was founded in 2000. There are participants from over 157 countries, and over 10,000 schools have participated in the activities of the ENO network. The ENO network aims to produce sustainable education materials and campaigns (ENO Suomeksi, 2021). Interviewing teachers in the WSSC event is a unique opportunity to do a case study research of expert teachers brought together by the ENO. This case study will also produce information for ENO use by providing knowledge network teachers' perceptions of EE and their students' environmental literacy.

Barriers to Environmental Literacy in a School Setting

The weak transition from environmental concern to pro-environmental behavior is caused by the so-called barriers (e.g., Gifford, 2011; Huoponen, 2023; Kollmuss & Agyeman, 2002). Only the most recent frameworks of EE (e.g., Cantell et al., 2019) take into account these barriers that may prevent students' pro-environmental behavior.

School-Related Barriers

Pre-service teachers seem interested in teaching EE (Álvarez-García et al., 2015). However, pre-service teachers' preparedness to teach environmental issues is low (Álvarez-

García et al., 2015; Miles et al., 2006). A study conducted in New Zealand by Dada et al. (2017) suggested that his lack of knowledge might especially be present on topics to which pre-service teachers have not been exposed before. Alarming this trend seems to apply to in-service teachers as well. A study conducted in Taiwan by Liu et al. (2015) found in-service teachers to primarily possess cognitive and affective components of environmental literacy. However, most of them fail to carry out these matters in practice. Also, teachers with low environmental literacy are unlikely to carry out EE (Liu et al., 2015).

Furthermore, previous studies have found that student-teachers' environmental knowledge is mainly gained from media, and knowledge is not at a sufficient level (Miles et al., 2006; Tuncer et al., 2009). A study conducted in Greece by Michail et al. (2007) proved the same for in-service teachers. Additionally, media use as a primary source of environmental information causes a lack of scientific knowledge of environmental problems (Michail et al., 2007). The study conducted in the USA by Khalid (2003) notices the same fact, concluding that pre-service teachers have many misconceptions about environmental problems caused mainly by media, which is the primary source of environmental information. Using non-professional environmental information sources as the primary source of environmental information applies to in-service teachers. This issue causes a lack of knowledge in carrying out EE (Pedretti & Nazir, 2014; Sosu et al., 2008). A study conducted in Canada by Pedretti and Nazir (2014) found that besides knowledge, teachers may also lack pedagogical strategies for carrying out EE.

Moreover, the marginalization of environmental educators is also a severe problem; others may perceive them as "tree huggers" in the working community, which may further cause a lack of empowerment for EE teachers (Evans et al., 2012; Pedretti & Nazir, 2014). The same problem has also been recognized in students' environmental behavior (e.g., Prabawa-Sear & Baudains, 2011). This phenomenon also relates to the fact that most school staff are not interested in carrying out EE (Pedretti & Nazir, 2014). To overcome this barrier, the whole school should participate in environmental actions, making it a social trend (UNESCO, 2019; Prabawa-Sear & Baudains, 2011).

However, the lack of adequate EE can be attributed to more than just teachers. Many of the barriers are related to the contradictory situation between teachers and the administration. For example, a case study of outdoor learning environments in Canada shows that a lack of administrative support hinders EE (Dring et al., 2020). A study conducted in Australia by Evans et al. (2012) found that teachers often suffer from a lack of time. This barrier is also related to the expectation that some teachers must use time and resources outside their normal work, which teachers often find an unfair expectation (Dring et al., 2020). A restrictive curriculum usually causes this time pressure (Ernest, 2007; Sosu et al., 2008). Furthermore, teachers may even get in trouble with the principal when emphasizing EE more than the curriculum would allow (Dring et al., 2020). Also, the emphasis on testing and standards may hinder teachers' abilities to implement EE (Ernest, 2007; Ernest, 2009). It is evident that although the teachers do not cause most of these constraints, they still hinder the effective teaching of EE.

A study conducted in Canada by Robertson and Krugly-Smolka (1997) found that environmental theorists tend to ignore real-life conditions by focusing on abstract ideas. Real-life conditions such as lack of acceptance from parents or administration often force teachers to promote actions that are already accepted and thus easy to incorporate into teaching (Robertson & Krugly-Smolka, 1997). These real-life constraints

may also be due to a lack of funding, resources, or transportation (e.g., Ernest, 2007; 2009; Evans et al., 2012).

Student-Related Barriers

Some factors may particularly affect students' environmental behavior in a school context. Previous studies have found that students' environmental literacy is often related to age. Young children entering school tend to show a relatively high level of environmental literacy which increases rapidly until the age of 10 and then dramatically declines from the age of 14 to the age of 18 (Evans et al., 2007; Otto et al., 2019). However, a study conducted in the USA by Larson et al. (2010) suggests that this is mainly the case with environmental attitudes and behavior, and conversely, the level of environmental knowledge usually increases throughout the school years.

Clearly, this decline in environmental literacy cannot be explained by the age of the students. Instead, the influence of students' friends and family has been studied. Based on a study conducted in the UK, Australia, and Canada by Palmer et al. (1999), it seems that parents seem to have a particularly positive impact on students' environmental literacy in early childhood. Nonetheless, in adolescence, peer effect may overcome parents' influence and be the determining factor in some environmental actions (e.g., Lee, 2010). However, based on the study conducted in the USA by Harness & Drosman (2011), it seems that if parents support the school's environmental efforts, it may increase their influence even among high school students.

Additionally, students in school are not separated from the outside world. Blatt (2013) has theorized that students' environmental actions in a school setting are formed by the interaction and emotional responses from environmental, consumer, social, and student identities. Thus, although students may find environmental matters important, they might be contradictory with other things in their lives, which may cause emotional distress and rejection. For example, reducing consumption is essential to EE, but students are often exposed to materialistic culture and assumptions (Blatt, 2013; Harness & Drosman, 2011). Moreover, environmental actions must be perceived as socially acceptable (Blatt, 2013; Prabawa-Sear & Baudains, 2011; Whitehouse, 2001).

Research Questions

Based on the fact that there are several pathways proposed for EE, and as school-related and student-related obstacles hinder the impact of EE, it is no wonder that operational environmental literacy seems difficult to accomplish. This study uses group interviews with highly motivated environmental educators of the ENO from across the globe to explore their perceptions of methods used by teachers in EE, barriers to EE, and their students' environmental literacy. The research questions are:

- 1) How do ENO expert EE teachers' teaching methods contribute to promoting environmental literacy, and what are their perceptions of enhancing these methods?
- 2) What are ENO expert EE teachers' perceptions of barriers in their environmental education?
- 3) What are ENO expert EE teachers' perceptions of their students' environmental literacy?

Method

Research Design and Participants

A case study can be used as a research method to examine individuals or groups (Yin, 2014). This study employs a qualitative case study approach to investigate perceptions of ENO's expert EE teachers participating in the WSSC on carrying out EE and their students' environmental literacy (see Ashley, 2012; Baskarada, 2014). This study can be referred to as an instrumental case study aiming to provide more knowledge on how to enhance EE by focusing on EE expert teachers' perceptions of the topic (Stake, 1994). Interviews are one of the most important data sources in case studies (Yin, 2014), and also this study uses interviews for gathering case study evidence. By focusing on the teachers' perceptions, it is evident that the approach shares some similarities with phenomenography (see Yates et al., 2012). High motivation towards EE can be seen as a control characteristic of the group (Knodel, 1993). Due to the event's tight schedule, the interviews had to be carried out on a single day. The data were collected by conducting group interviews with the participants. Group interviews enabled discussion-like events where participants had the opportunity to comment on each other's responses, and it also enabled the integration of interviews into the WSSC schedule (see Longhurst, 2016). The other option was to conduct focus group interviews, but initiating long conversations between participants were expected to be challenging due to participants' varying English skills. The interaction mostly involved answering the researcher's questions, and the participants occasionally commented on each others' responses. Thus the method used in this study is better characterized as a group interview rather than a focus group interview (see Brown & Edmunds, 2011). Interviews were semi-structured (see Fontana & Frey, 1994). This is common in case studies (Yin, 2014). Participants were asked certain common questions. Other questions were adjusted based on each interview.

Participants decided themselves with whom they would participate in the interviews. This way group may simulate a group of friends with common interests (see Longhurst, 2016). The groups were diverse, with different nationalities and EE experiences. The nationalities and experiences can be seen to work as break variables (Knodel, 1993). The interviews were video-recorded and audio recorded to ensure the participants' identification and sufficient voice quality of the recordings. After the interviews, the recordings were transcribed and then analyzed using the Atlas.ti program.

The data for this study were collected in the summer of 2019 at the WSSC. During the WSSC, 48 educators were interviewed in six groups. The number of participants varied from 6 to 9 in an interview. 6 hour-long interviews were done as the WSSC organizers planned a six-hour slot for interviews at the event. Participants were invited to interviews during the interview day. They participated in the info where the researcher clarified the study topic, the data gathering, data handling, and participants rights. After that, they decided on their participation. The interviews were voluntary; not all teachers participated. Table 3 summarizes the descriptions of the participants. Of the interviewed teachers, eight were from Africa, seven were from America, including South and North America, 13 were from Asia, including Australia and Oceania, and 19 were from Europe. At the beginning of the interview, the participants were asked to tell which age group they teach: 10 identified themselves as lower secondary school teachers, and 15 as upper secondary school teachers. Seven stated that they were working in the educational field. Still, they did not identify themselves as teachers. Seven worked in a

primary school, three worked at a university, two identified themselves as secondary school teachers, one worked in a preschool, one in non-formal education, and one in a vocational school. In the case of 10 participants, the age of students remained unclear.

Table 3

Descriptions of the Participants of the Study

Topic	Groups	Number of participants in a group
<i>Region</i>	Africa	8
	Americas	7
	Asia, Australia, and Oceania	13
	Europe	19
<i>School level</i>	Lower secondary school	10
	Upper secondary school	15
	Not a teacher but work in the educational field	7
	Primary school	7
	University	3
	Secondary school	2
	Pre-school	1
	Non-formal education	1
	Vocational school	1
	Unclear	10
<i>Subject</i>	Geography	8
	Biology	7
	English as a foreign language	7

As for the taught subject, there was no clear pattern to be identified. Eight teachers taught geography, seven taught biology, and seven taught English as a foreign language. Other subjects were mentioned a maximum of four times. 30 of the participants indicated that they had been teaching for over ten years, four of the participants had taught for five to ten years, and two for less than five years. Other participants did not clarify this matter. The participants' background information showed that the group was highly heterogeneous in terms of geography, educational contexts, and taught subjects. This heterogeneity of participants sets limitations but also enables a unique data set of expert teachers that may help clarify EE's core barriers and enablers and provide valuable information for the ENO. The participants had experience in education, most having more than ten years of experience. As the teachers voluntarily participated in the event of their interest, it is fair to say that they were somewhat experts in EE. The participants are coded anonymously. This is done for two reasons. (1) This case study focuses on the ENO's expert EE teachers. They come from across the globe and teach at different school levels, but they are brought together by involvement in the ENO's actions and shared interest in EE. This membership and shared interest are the control factors of this study. (2) Anonymity is a crucial part of this kind of case study. If the teachers' continents and school levels are used for analysis, it jeopardizes teachers' anonymity both within and outside the ENO's network. When referring to the comments of a particular participant, the letter P and the number of that participant are used. These numbers are randomly selected.

Data Collection

The researcher of this study carried out the data collection. Participants were asked: background information, how they carry out EE (to examine if expert EE teachers are able to carry out effective EE), how they would like to carry out EE (to examine if they are satisfied with it and how they would enhance EE), what hinders their EE (are these expert EE teachers suffering similar barriers to other teachers in previous studies), and on what level they find their students' environmental knowledge, attitudes, and behavior to be (is the expert EE teachers EE effective). Also, additional questions were asked based on the responses of the participants. These additional questions differed between interviews. Thus, the interviews were not identical. Participants were encouraged to respond and offered a chance to respond. However, not all participants answered every question, which is normal in group interviews (see Smithson, 2000). Participants' rights were clarified before the interviews. Also, after the interview, participants were reminded that they still have the right to ask for the deletion of the data concerning them.

Data Analysis

The data analysis was carried out by the researcher of this study. This study used qualitative content analysis because it enables further interpretations of the data (Schreier, 2012). This analysis is done by combining concept-driven and data-driven strategies (see Schreier, 2012). A coding frame (see Schreier, 2012) was employed for categorization: First, the collected data were divided into included and excluded categories. Included responses contained the teachers' background information, information on students' environmental literacy, or information on environmental education. On the contrary, responses that did not contain any of the above information were excluded from the analysis. The conceptualization of Hollweg et al. (2011) and Liang et al. (2018) was used to categorize the teachers' methods. Similarly, the conceptualization of Roth (1992) and Fang (2020) was used to categorize the teachers' perceptions of students' environmental literacy. The categorization of the teachers' perceptions of barriers to EE is based on school-related and student-related barriers. However, the subcategories are formed with a data-driven strategy (see Schreier, 2012). Although the analysis process seems straightforward, it involved multiple reviews of the data, and the data-driven categorization was also performed multiple times.

Results

Teaching Methods Used by the Teachers

The teachers were asked to elaborate on their methods in EE. These methods are divided into cognitive, affective, and behavioral groups based on what they are targeted to enhance (see Liang et al., 2018). The cognitive literacy category is used if the teachers describe EE methods that focus on enhancing knowledge of environmental issues. The affective literacy category is used if the teacher's methods focus on responding to environmental issues, including environmental awareness and sensitivity, environmental values, and decision-making attitudes about environmental issues. Behavioral literacy categorization is used when the teacher's methods focus on skills and abilities that you know how and when to apply, including promoting intentions to act, environmental action strategies

and skills, and involvement in responsible environmental behavior. This classification is further elaborated with method examples in Table 4.

This categorization enables discussion of how the methods used by expert teachers can enhance students' environmental literacy. The participating teachers gave quite specific methods they were using, and many participants tended to use different kinds of methods simultaneously. Table 5 shows how the teachers' methods are divided between these elements. Cognitive literacy was represented 15 times, affective literacy 20 times, and behavioral literacy eight times. However, it is important to note that a teacher's response can represent multiple categories if they are using numerous methods. Furthermore, Table 5 presents examples of each element from the teachers' responses. The responses are distributed evenly between continents and school levels, so no pattern is present.

The teachers were also asked to clarify what they find essential in effective EE. The same framework from Liang et al. (2018) was utilized in this case. Cognitive literacy was represented five times, affective literacy five times, and behavioral literacy ten times. The response of one teacher can be represented in more than one category. Many of the participants find it hard to answer this question.

Table 4

Examples of the Teacher Method Classification Used in this Study

Literacy element (Liang et al., 2018)	Targets (Liang et al., 2018)	Examples of methods from this study
Cognitive	• Knowledge of natural systems • Knowledge of environmental issues • Knowledge of appropriate action strategies	• Discussions • Investigating environmental phenomena • Presentations on environmental phenomena
Affective	• Environmental awareness and sensitivity • Environmental values • Decision-making attitudes about environmental issues	• Planting trees together and valuing planted trees • Picking trash together from public places • Art exhibitions
Behavioral	• Intentions to act • Environmental actions strategies and skills • Involvement in responsible environmental behaviors	• Enabling and providing opportunities for student actions in school • Project-based learning where the problem is recognized, analyzed, and tried to solve

Although the number of responses to this question seems small compared to the total number of participants, it is noteworthy that the teachers seem to emphasize the importance of behavioral literacy aspects, which are underrepresented in the carried teaching methods.

The comments referring to cognitive literacy usually indicated that there is a need to at least start EE in the participant's country or to increase the provision of EE current, at almost a non-existent level. For example: (P16) *"For the last question (What would be essential in ideal EE?) is to include it in the curriculum."*

Table 5

Teaching Elements of Environmental Literacy and Example Responses

Element	Example
Cognitive N = 15	(P33) <i>"Okay. So, in our biology curriculum in our province, there are a couple of environmental-related topics that we discuss about. So, we talk about the carbon cycle and climate change, and water cycle and acid rains and the nature nitrogen cycle and nitrification. So, we talk about it, and we discuss it, and we do some lab activities. Like biological oxygen.... things like that. So, it's in our ecology session, but we don't do a lot of explicit environmental education."</i>
Affective N = 20	(P38) <i>"As it's not graded or not included in the curricula. So, we should motivate students to do it. For example, I say I will do our recycling project for nature around the school, and we will give certificates and take it to the school board or website. So, we should attract students to do it because it's not included. Maybe the most active students want to participate, but the others will say "I have to study", "I have to do things related to that curriculum". So, most activities we do try to attractive the students. It will give them the motivation to do these activities. Maybe I'll try a trip outside of the city. Maybe certificates for participating."</i>
Behavioral N = 8	(P23) <i>"And in most cases, it relies on the teacher how you can give continuously make students to be involved. Because, well, you can do this, and let's say we can develop reading, speaking, and listening skills. Yeah, and it's done, but actually, I prefer, I enjoy when students are doing something related to real life, for example, how much water do you use every day, and they start calculating, making tables, well, this is me, this is my family, and this is total. "Wow, I'm so surprised! I use so much water." This is not just that we have made some calculations, and that's it. We have to move on to make this sort of report on what to reduce. What to do to make things better. It's a kind of research."</i>

Affective literacy and cognitive literacy were equally represented. This is not surprising because the teachers' comments often included both cognitive and affective literacy components. Often these responses started with the components of cognitive literacy and moved on to the components of affective literacy. The methods of affective literacy focused more on increasing sensitivity to attitudes. For example:

For me, the starting point would be raising awareness as it has been put through education, not with this generation but with the students that we teach. I think, in my view, our mindset is already messed up. Allow me to use that term. It is the next generation that we are trying to bring up we have to reinstate... So through awareness, they grow to appreciate the world they grow to understand that we need to be good caretakers of this world. As teachers, as parents, we should not do it for our own benefit. We should do this for the benefit of the next generation. So, a change to mindset is very, very important. (P14)

However, most of the teachers' responses related to behavioral literacy, representing the longing for developing intentions to act and involvement in environmental behaviors. For example:

A way of life, I think. First of all, it has to be a way of life if you want to teach it if you want to give them an example. It can't be just a lesson. You can't talk

about it, and that's it. It has to be the lesson, or the group has to be part of something, part of a way of life. I believe that if it will be a way of life, it will be much more successful. (P5)

The results concerning ideal EE seem to indicate that the teachers are longing for more behaviorally active EE. However, it is worth noting that only some of the teachers participated in discussing this matter.

Teachers' Perceptions of Barriers to Students' Environmental Literacy

During the discussion, the participants also shared their views on issues that might affect students' environmental literacy. Such issues can be divided into school-related and student-related barriers to EE. Barriers related to school and teaching were categorized as school-related barriers, and barriers concerning students or barriers closely linked to students were categorized as student-related barriers. More detailed subcategories were used based on data-driven classification. Table 5. presents the findings of this analysis.

School-Related Barriers

First, many of the teachers pointed out problems in the curriculum or the school's focus. The curriculum was found too strict, leaving little room for EE activities, or lacking focus on EE entirely. The teachers felt that primary school students were naturally interested in their environment. However, a strict curriculum was thought to reduce their interest in environmental matters (see Table 6). Seventeen teachers mentioned this. However, some teachers referred to the curriculum as the reason for their students' high environmental literacy. For example:

I'm a bit more confident that environmental education is very high in (name of the country). Because we start teaching about the environment from class 4, which is about nine years old, and then it goes until university, and it's incepted even when you are grown. (P31)

Second, the teachers also often feel that there are too many topics to go through. Because of this time pressure, there is no time to focus on EE (see Table 6). As with teachers' interests, there are differences in the goals of schools and governments when it comes to EE. The focus of schools and governments can act either as an enabler or a barrier to EE. Four teachers mentioned this barrier.

Third, some teachers stated that the school is highly focused on exams and grades, which makes the implementation of EE challenging for teachers. Furthermore, this might even influence students. When they are not graded on EE activities, they might find these activities unnecessary and not pay attention to them (see Table 6). Three teachers mentioned this barrier.

Fourth, the teachers also elaborated that although they could have ideas and time for EE, they might suffer from a lack of support. They might be the only teachers who focus on environmental matters. Large EE projects may thus be difficult to organize. Also, the school administration may fail to support the EE provided by the teachers, and the actions that the teacher can carry out may be restricted. Nine teachers mentioned this barrier.

Table 6

Barriers to Teaching Environmental Literacy

	Barriers	Example
School-related barriers	Strict Curriculum N = 17	(P12) <i>"I think young children are ecologists by themselves; they feel the love for earth... When they grow up, they get frustrated and imprisoned by this theoretical knowledge that we are putting in them all the time, and they are not in contact with practical things. Which, like first graders and kindergarteners, are full of, but later, they are just losing contact. I think our curriculums are too strict."</i>
	Lack of time N = 4	(P22) <i>"Of course, in English, we have units. So, I try to align to the unit of an environment with project work. In there, I find opportunities in planting and in the environment. This is what I do every year. I reach unit seven which I try to do this unit for."</i>
	Pressure of grading N = 3	(P45) <i>"The most important issue is that environmental education is not examinable. The stuff is not examinable. No one care. Is reading no one care. We can only give them some incentive. Then like, what I did is I used sense spots because it can enhance learning. But this only increase in some extent, but when we bring them on field trips, they think that this is a great time for a picnic not for field trips. Not doing something on a field trip because it's not graded. And also, they know that field trip is not included in their mass. So, they never care. That's the main problem."</i>
	Lack of support N = 9	(P15) <i>"We have, for example, 120 solar cells on the roof of the school building, and when I asked the principal, 'What do we do with this? Why do you have this?' and he said, 'It's just economical', only that. That's the attitude of the principal. It's going down on the organization."</i> (P22) <i>"There is no funding. Even the last thing I did here before I came was planting trees. I bought them from my personal budget."</i>
	Lack of resources N = 6	(P44) <i>"Now we don't have Internet in the school. We don't have a good laptop to use or a projector. So, we don't have the possibility to walk to hiking in nature for every weekend with a small group. Same time we have big political problems, and I saw that the new generation of youth are very... I can say easygoing. But not so active in expressing ideas or active in expressing their vision or their actions for improving the environment. I'm sorry about this."</i>
Student-related barriers	Lack of interest N = 16	(P5) <i>"I think, if I want to be honest, most of them care for themselves in this age... You can find a few that really stand for it. Because I think in that age twelve, thirteen, fourteen, it's not something what they care for."</i>
	Lack of possibilities to act N = 3	(P27) <i>"... And I see in my senior students, especially, they have done through science curriculum and through technology curriculum, and they have learned a lot about climate science. They know what's happening, but they know it enough for despair and to feel hopeless."</i>
	Parents N = 8	(P4) <i>"But we have difficulties in families. So, we start something with children, but families can't help us. So, actually, children got the information, and they, they teach their parents about things what have been."</i>
	Peer pressure N = 3	(P43) <i>"They know to not something wrong but in the reality when see everyone is doing same they start to do same."</i>

See next page for continuation of table

Continuation of Table 6

Society N = 15	(P43) <i>"But parents and society play a big role. How they are behaving. It's like copying by kids. Only if your kids are against of the society, the don't like this, but it's only a small number."</i>
Superficial knowledge N = 8	(P22) <i>"Okay, let me tell you about, for example, about the knowledge. I think it's very limited and superficial. Because I generally start by asking, 'What is global warming? Can you explain me this phenomenon?'" So, the explanations I generally get are not an explanation of global warming. So, they need more information. They know that it is a climatic phenomenon, but how it happens, so on, they confuse it with the ozone layer and other things."</i>

Fifth, some teachers felt the school lacked the resources to carry out effective EE. This barrier may be caused by, for instance, the differences between public and private schools or the school's poor financial situation. Therefore, teachers may lack the possibility to use the Internet or electronic devices, or they might be unable to take students in nature due to constraints. Six teachers mentioned this barrier.

Student-Related Barriers

Student-related barriers are the ones that the teachers described as occurring outside of the school. First, they may refer to a lack of interest in environmental matters. Many teachers stated that adolescent students are not interested in environmental issues or are more interested in other topics. This lack of interest may cause their EE to be weak (see Table 6). On the other hand, many teachers highlighted that primary school students and kindergarteners are highly interested in environmental matters and usually possess the components of operational environmental literacy. Sixteen teachers mentioned this barrier.

Second, the teachers also elaborated that some students are suffering from the lack of possibilities to act. This may cause, for example, apathy or frustration among students. One of the teachers stated that this is usually caused by knowledge, as students know so much that the knowledge causes them to feel powerless as they do not have the means to transfer it into environmental actions. Another teacher stated that students get frustrated because of the dominance of theoretical knowledge and lack of practical exercise. However, the teachers also stated that this is not the case with all students, as they described some students as activists. Three teachers mentioned this barrier.

Third, the teachers felt that communication between the school and parents is weak. In practice, this means that the parents are not supporting the environmental matters that the teachers are trying to promote. For instance, the teachers may encourage recycling in the classroom and at the school, but the parents may fail to promote recycling at home. The teachers felt that in this way, the parents undo their EE. Eight teachers mentioned this barrier.

Fourth, the teachers stated that they feel that students suffer from peer pressure. By this, the teachers mean that students would carry out environmental actions if they were on their own, but the pressure of their peers causes them to act non-environmentally. This effect was emphasized, for example, with regard to littering and recycling. However, some teachers also elaborated that students experience positive peer pressure. According to this view, the pro-environmental behavior of peers can promote individual pro-environmental behavior. However, positive peer pressure was considered an uncommon

phenomenon. The teachers often described pro-environmental individuals as activist students who carry out environmental actions despite the majority's failure to act. Three teachers mentioned this barrier.

Fifth, the teachers stated that they feel that society may hinder students' environmental literacy. According to the teachers, this is the case especially if students find that the things they are taught at school do not materialize in the real world; for example, littering was often mentioned to occur in society despite the teachers' efforts. This contradiction may hinder the effects of EE provided by the teachers. Fifteen teachers mentioned this barrier.

Sixth, the teachers also stated that they find their students to suffer from superficial knowledge. Many teachers feel that students are only aware of the most basic environmental phenomena. This lack of knowledge reflects the lack of operational environmental literacy. It is difficult to expect proper behavior without knowing how to solve environmental problems. In addition, the teachers reported that students' behavior is often superficial. Eight teachers mentioned this barrier.

Teachers' Perceptions of Students' Environmental Literacy

Due to its ambiguous nature, using the concept of "environmental literacy" is avoided in the questions. However, based on the environmental literacy continuum (Table 1), the participants were asked three questions about their students' environmental literacy: (1) to elaborate on their perceptions of their students' environmental knowledge, (2) to elaborate on their perceptions of their students' environmental attitudes, and (3) to elaborate on their perceptions of their students' environmental behavior. The teachers were able to name the level of their students' knowledge, attitudes, and behavior. However, when asked for clarification, most teachers were often unable to specify the underlying factor affecting them.

The category of nominal literacy is used when the teachers describe their students as having basic environmental knowledge, mostly lacking environmental attitudes, and failing to conduct environmental action (see Table 1). The category of functional literacy is used when the teachers describe their students as having environmental knowledge and at least some environmental attitudes. However, these students fail to carry out most environmental actions, especially if the actions require personal investment. Lastly, operational literacy is used when the teachers describe that their students have environmental knowledge and express environmental attitudes, and their environmental consciousness is transferred into actions independently. As shown in Table 7, thirteen teachers indicated that their students have nominal literacy. Nine teachers indicated functional literacy, and seven operational literacy. However, the classification proposed by Roth (1992) and Fang (2020) seemed inadequate in this case. Four teachers stated that their students are below nominal literacy as they fail to demonstrate any environmental knowledge. Nine teachers stated that their students' environmental literacy skills varied as some students possess more advanced environmental literacy skills than others. Some teachers elaborated in detail on the levels of different environmental literacies, and others simply stated that, for example, rural students are more environmentally responsible than students in the cities. Because of these findings, categories "below nominal literacy" and "varying literacy" have been added to the continuum proposed by Roth (1992) and Fang (2020). Examples of this classification are shown in Table 7.

There were no clear patterns between school levels or geographical regions in nominal, functional, or operational literacy. However, it is worth noting that the teachers often stressed that some of their students possess, for example, attributes of operational literacy, and others fail to achieve this level. For example,

I think half of the students are really well informed and would say the other half.... they are staying in a thin cosmetic level. You know, pick up the paper and, you know, things like that, and they do not know the background... (P13)

Moreover, some teachers described young students as more environmentally literate than older students. For example,

I think we need to focus on primary-level students also, they are very much like you said... They listen to us. Actually, they listen to us, but children sixteen and seventeen they do listen to us, but we have to force them to do. (P8)

Table 7

Teachers' Perceptions of Students' Environmental Literacy

Level of environmental literacy	Example
Below nominal literacy N = 4	(P7) "Our students are not conscious about the environment realistically because public education in (name of the country) doesn't focus on it. And like I said, we are a new school, so we pull students from a lot of public schools. So, their knowledge about environmental studies is very low."
Nominal literacy N = 13	(P15) "I'm not really positive about the positivity of our students. It's not the end program... And if we do some environmental education, students start to ask, "Do we really need to do this?". That's the first question. "This is a big problem, but I think knowledge is on quite a good level. About climate change, I think knowledge is alright."
Functional literacy N = 9	(P33) "I would say in (name of country), I think the awareness is pretty high, and all is pretty high on the student part. I think their motivation is pretty high, but I think, and perhaps it's more our fault than theirs, but sometimes the actions and the behaviors don't also follow the line of the knowledge."
Operational literacy N = 7	(P12) "I think our students know a lot about it. In kindergarten, they know how to take plastic, paper, garbage, and everything. What they can do about it, actually. And they are promoting walking and so on. So, they are aware of this at their age."
Varying literacy N = 9	(P2) "It's about the level of education. If we are talking about public schools, it's very bad. If we are talking about the private sector and international schools, they are fine..."

In addition, some teachers stressed that rural or urban students are more environmentally literate. However, there was no pattern present based on the living environment. For example, (P28) "Average, it depends on surroundings. If we are living in the city, they are open to many issues, and in the rural area, the environmental issues are very small. I'm basically in the rural area."

Furthermore, some teachers stressed that, in their opinion, some of their students are the so-called activist students who are at the level of operational environmental literacy, while others fail to achieve this level of environmental literacy. For example,

There is a girl who is actually a junior still 14, and she has been one of our leading speakers at our student strike for climate marches... So, she is one of those activists she is one of those leaders in my classroom, you know... But yeah, I would say, on average, the general knowledge is kind of at the worst level. It's enough for despair but not enough for hope... (P27)

There is a great diversity of environmental literacy, which is not connected to regions and school levels. And the teachers also found this diversity to be present among students.

Discussion

This study set out to clarify expert teachers' perceptions of effective EE and their perceptions of students' environmental literacy. The study was guided by three research questions. The first research question aimed to identify how teachers' methods in EE enhance students' environmental literacy. The assumption was that the expert teachers could fill in the missing pieces of effective EE. During the interviews, the teachers indicated a variety of methods they employ in EE. The findings were categorized using the (environmental literacy) framework of Liang et al. (2018). Methods that develop affective literacy were most frequently mentioned by the teachers, followed by methods that develop cognitive literacy, then methods that develop behavioral literacy. On the other hand, methods that promote behavioral literacy were often mentioned when discussing the ideal components of EE.

The concept of environmental literacy is rarely addressed in the pathways of EE (e.g., Cantell et al., 2019; Palmer, 1998). However, there are clear similarities between these pathways and the environmental literacy categories outlined by Liang et al. (2018). The teachers in this study are lacking methods that promote behavioral literacy. At the same time, the elements of behavioral literacy are exactly what the teachers wish to promote. Other EE frameworks include a similar kind of "final step" to behavioral literacy. For example, Hungerford and Volk (1990) named the last step before citizenship behavior as empowerment variables, including knowing how to use environmental actions strategies, locus of control, and intention to act. Likewise, Koskinen and Paloniemi (2010) referred to the last step before environmentally responsible behavior as environmental actions competence, which they explain to be the individual's capacity to act responsibly. This "final step" is the last step toward pro-environmental behavior in many pathways.

Although the teachers in this study seem to struggle with implementing behavior-oriented environmental education, they seem to differ from many teachers in previous studies. Like those in previous studies, the teachers in this study are interested in teaching EE (see Miles et al., 2006). These teachers seem to be experts in EE, which is usually not the case with teachers (see Liu et al., 2015; Miles et al., 2006). In this case, the fact that teachers struggle to implement effective EE is not necessarily due to a lack of knowledge or preparedness but rather due to other barriers.

The second research question aimed to identify these barriers. Only the most recent frameworks of EE consider that there are barriers that may hinder the effectiveness of EE. This study found that teachers struggle with a strict curriculum, lack of resources, the pressure of examination, lack of time, and lack of support that limit the implementation of EE. Furthermore, besides these school-related factors, the teachers also found students' lack of interest, lack of possibilities to act, parents, peer pressure, students' superficial knowledge, and society to hinder the effectiveness of EE.

Previous studies on these types of barriers have generally been conducted using theoretical approaches (Kollmuss & Agyeman, 2002). However, most of the barriers identified in this study had been recognized before. For example, time pressure had been found to restrict teachers (Ernest, 2007; Sosu et al., 2008). Similarly, this study stresses that teachers find the curriculum to be too strict, which reduces students' interest in environmental matters. This has also been noticed in previous studies. In particular, teachers may find it difficult to implement ambiguous EE under the pressure of various subjects (Robertson & Krugly-Smolka, 1997).

Further, this study found that teachers were lacking resources, and support. These findings are similar to previous studies, which have found that teachers suffer from marginalization, time pressure, and real-life constraints (e.g., Ernest, 2007; Pedretti & Nazir, 2014; Sosu et al., 2008). Furthermore, the teachers in this study stressed that the pressure of testing and grading restricted them. According to the teachers, when students know they are not being graded, they fail to concentrate on environmental actions. This finding can be considered novel. Given these school-related barriers, it is no wonder that the teachers in this study struggle to implement effective EE, despite their motivation.

Also, the student-related barriers identified in this study share similarities with the findings of previous studies. The teachers in this study found that parents, peers, and society may hinder the effectiveness of EE. The impact of parents and peers is a well-studied matter and may either hinder or enable pro-environmental actions (e.g., Harness & Drossman, 2011; Lee, 2010; Palmer et al., 1999). Further, the teachers in this study elaborated that the students often lacked interest or show apathy towards environmental issues. Previous studies have confirmed that these matters may hinder students' environmental actions (Nagel, 2005). Blatt (2013) points out that if the school promotes environmental actions that are not promoted in society and among students' families and peers, it may cause the student to feel emotional distress and disinterest towards environmental matters. These feelings may also be promoted if conflicting values, such as materialistic values, are supported outside the school (Blatt, 2013; Harness & Drossmann, 2011). This study supports the findings of previous studies that the discrepancy between school and the outside world may significantly hinder the effectiveness of EE. Furthermore, the educators in this study found their students' knowledge superficial, limiting them from adopting operational literacy via EE. This finding can be considered new as previous studies have suggested that environmental knowledge increases throughout childhood and adolescence (Larson et al., 2010). However, the quality of environmental knowledge is a less studied matter. Given the many student-related barriers identified in this study, it is reasonable to assume that they hinder the impact of EE on students' environmental literacy.

The third research question aimed to clarify how the teachers perceive their students' environmental literacy. The results indicate that the teachers in this study find most of their students to be at the nominal level of environmental literacy. Functional and opera-

tional literacy were fairly evenly represented. However, it is worth noting that the teachers often mention that students in primary education usually possess the elements of functional literacy, but their environmental literacy declines during adolescence. This finding seems to be in line with previous studies (Evans et al., 2007; Otto et al., 2019). Many of the teachers emphasized that they found some of the students to have operational literacy skills, despite most of them failing to reach this level. They called these students “activist students”. For example, one of the teachers elaborated that these students tend to provide suggestions on how to make the school environment more environmentally friendly.

Although environmental clubs were not the focus of this study, surprisingly, eight teachers mentioned that their school had an active environmental club. These clubs were consistently found to be effective in EE. However, this finding is not surprising as Eco-Clubs are widely used to promote EE (Roberts, 2009).

Overcoming the barriers and the issue of ineffective EE calls for multiple approaches. The school culture should become more supportive of environmental actions to overcome the lack of support and peer pressure among students. Even more important seems to be the implementation of curricular changes that would enable more effective EE and reduce the restrictive effect of the curriculum and the pressure of examination and time. One solution could be to promote students’ involvement in environmental club activities during or outside the school day. This could help overcome the issue of a strict curriculum and lack of time, as the exercises would be done outside the classroom. Further, the club could be organized by multiple teachers, and the club activity could be included in the curriculum, for example, by awarding credit points. This could increase the students’ motivation and help to overcome the barriers of lacking support and the pressure of examinations.

This kind of club activity may attract the interest of environmentally conscious students and allow them to take environmental action and reduce apathy. Moreover, the atmosphere in such a club might promote an environmental lifestyle and help reduce peer pressure. Of course, the successful implementation of this kind of education requires additional training for teachers. Additionally, supportive school culture is essential. This pathway is something worth exploring in future research. It would also be useful to interview activist students carrying out environmental actions at school and outside school and find out what motivates them to act pro-environmentally and what role the school and their parents play in their environmental literacy.

Limitations

This study has some limitations. The participants of this study were teachers who participated in the WSSC. They can be considered highly motivated to promote EE and, therefore may not represent the average teacher. Additionally, the participants represented a wide range of countries and educational contexts. Their students also represented a wide range of age groups, from kindergarten age to adults. Because of this variety, generalizations based on these factors cannot be made. Alternatively, examining the impact of the teachers’ background and teaching grade level could be an interesting direction for future research. However, these were excluded from the scope of this study due to a large number of previous studies on the effects of background factors and because of the unique opportunity to focus on ENO network expert EE teachers.

The teachers' understanding of environmental education varied widely, from actual environmental education to health behavior-related actions. The language barrier may have caused some misunderstandings. Any responses with identifiable misconceptions were excluded from the analysis. The concept of environmental literacy was purposely avoided in the discussion due to its ambiguous nature. More straightforward terms, such as environmental knowledge, attitudes, and behavior, were used instead. In addition, the participants may not have been able to fully describe their perceptions in a foreign language. The language barrier was an explicit limitation of this study. However, interviewing expert EE teachers from around the world enabled the collection of a unique set of data.

Using group interviews as a data collection method also has its limitations. In this study, the interviews resembled conversations by participants commenting on each other's responses and complementing their own responses based on others' responses; the researcher steered the discussion with questions and comments when necessary. Not all participants responded to every question. The language barrier most likely caused this, but some participants also felt that they had nothing to say about the topic. Also, because participants commented on each other's responses, it enabled to gather the information that would have been left undiscovered with solo interviews. However, the participants' comments and the semi-structured interview method made the interviews dissimilar. However, the main topics remained the same throughout the interviews. Overall, despite its limitations, this method helped to identify the key factors these expert teachers consider important regarding EE and students' environmental literacy. In addition, the group of teachers interviewed in this study is unique and provides a new global approach to EE teaching.

Conclusions

By interviewing ENO's expert EE teachers, the study identified that most participants preferred methods that promote cognitive literacy or affective literacy. A minority of the teachers used methods that promote behavioral literacy. However, teachers seem to mostly long for methods that promote behavioral literacy. The study also found barriers to teaching environmental literacy. These are school-related barriers: strict curriculum, lack of resources, the pressure of grading, lack of time, and lack of support. And students-related barriers: lack of interest, lack of possibilities to act, parents, peer pressure, superficial knowledge, and society. Teachers also clarified their students' environmental literacy. Most often, teachers mentioned their students to be on nominal literacy. However, functional literacy and operational literacy were represented at almost even times. Varying literacy was added to the continuum as many of the teachers referred to varying literacy caused by individual and contextual factors. Surprisingly there was no pattern present in the causes of the variety. Below nominal literacy was added because teachers referred students to lack any environmental knowledge, attitudes, and behavior. When planning to enhance EE, it will be important to acknowledge these barriers that even the expert EE teachers experience and aim to support teachers' endeavors to use methods that promote operational literacy.

Acknowledgments

I would like to express my gratitude and appreciation to the associate editor and the anonymous referees for their valuable comments and suggestions that have considerably improved this article.

No potential conflict of interest was reported by the author.

Funding details. This work was supported by the Finnish Cultural Foundation under grant No. 00200366

References

- Álvarez-García, O., Sureda-Negre, J., & Comas-Forgas, R. (2015). Environmental education in pre-service teacher training: A literature review of existing evidence. *Journal of Teacher Education for Sustainability*, 17(1), 72–85. doi: 10.1515/jtes-2015-0006
- Ardoin, N. M., Clark, C., & Kelsey, E. (2013). An exploration of future trends in environmental education research. *Environmental Education Research*, 19(4), 499–520. doi: 10.1080/13504622.2012.709823
- Ashley, J. (2012). Case study research. In J. Arthur, M. Waring, R. Coe, & L. V. Hedges (Eds.), *Research methods and methodologies in education* (pp. 31–40). Los Angeles, Sage.
- Baskarada, S. (2014). Qualitative case study guidelines. *The Qualitative Report*, 19(40), 1–25.
- Blatt, E. N. (2013). Exploring environmental identity and behavioral change in an Environmental Science course. *Cultural studies of Science Education*, 8(2), 467–488. doi: 10.1007/s11422-012-9459-2
- Brown, G., & Edmunds, S. (2011). *Doing pedagogical research in engineering*. Engineering Centre: Leicestershire.
- Cantell, H., Tolppanen, S., Aarnio-Linnanvuori, E., & Lehtonen, A. (2019). Bicycle model on climate change education: Presenting and evaluating a model. *Environmental Education Research*, 25(2), 717–731. doi: 10.1080/13504622.2019.1570487
- Carmi, N., Arnon, S., & Orion, N. (2015). Transforming environmental knowledge into behavior: The mediating role of environmental emotions. *The Journal of Environmental Education*, 46(3), 183–201. doi: 10.1080/00958964.2015.1028517
- Chawla, L., & Cushing, D. F. (2007). Education for strategic environmental behavior. *Environmental Education Research*, 13(4), 437–452. doi: 10.1080/13504620701581539
- Clark, C. R., Heimlich, J. E., Ardoin, N. M., & Braus, J. (2020). Using a Delphi study to clarify the landscape and core outcomes in environmental education. *Environmental Education Research*, 26(3), 381–399. doi: 10.1080/13504622.2020.1727859
- Collado, S., Staats, H., & Sancho, P. (2019). Normative influences on adolescents' self-reported pro-environmental behaviors: The role of parents and friends. *Environment and Behavior*, 51(3), 288–314. doi: 10.1177/0013916517744591
- Dada, D. O., Eames, C., & Calder, N. (2017). Impact of environmental education on beginning pre-service teachers' environmental literacy. *Australian Journal of Environmental Education*, 33(3), 201–222. doi: 10.1017/ae.2017.27

- Dring, C. C., Lee, S. Y., & Rideout, C. A. (2020). Public school teachers' perceptions of what promotes or hinders their use of outdoor learning spaces. *Learning Environments Research*, 23, 369–378. doi: 10.1007/s10984-020-09310-5
- ENO Programme. (n.d.). *ENO Suomi*. <https://www.enoprogramme.org/suomeksi/>
- Ernest, J. (2007). Factors associated eighth K-12 teachers' use of environment-based education. *The Journal of Environmental Education*, 38(3), 15–32. doi: 10.3200/JOEE.38.3.15-32
- Ernest, J. (2009). Influences on US middle school teachers' use of environmentbased education. *Environmental education research*, 15(1), 71–92. doi: 10.1080/13504620802710599
- Evans, G. W., Brauchle, G., Haq, A., Wong, K., & Shapiro, E. (2007). Young childrens' environmental attitudes and behavior. *Environment & Behavior*, 39(5), 635–659. doi: 10.1177/0013916506294252
- Evans, N., Whitehouse, H., & Gooch, M. (2012). Barriers, successes and enabling practices of education for sustainability in far North Queensland schools: A case study. *The Journal of Environmental Education*, 43(2), 121–138. doi: 10.1080/00958964.2011.621995
- Fang, W.-T. (2020). *Envisioning environmental literacy: Action and outreach*. Springer Nature.
- Fontana, A., & Frey, J. (1994). The art of science. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 361–376). Sage Publications, Thousand Oaks.
- Frick, J., Kaiser, F. G., & Wilson, M. (2004). Environmental knowledge and conservation behavior: Exploring prevalence and structure in a representative sample. *Personality and Individual Differences*, 37(8), 1597–1613. doi: 10.1016/j.paid.2004.02.015
- Gifford, R. (2011). The dragons of inaction: psychological barriers that limit climate change mitigation and adaptation. *American Psychologist*, 66(4), 290–302. doi: 10.1037/a0023566
- Harness, J. M., & Drossman, H. (2011). The environmental education through film-making project. *Environmental Education Research*, 17(6), 829–849. doi: 10.1080/13504622.2011.618626
- Holbert, L. R., Kwak, N., & Shah, D. V. (2003). Environmental concern, patterns of television viewing, and pro-environmental behaviors: Integrating models of media consumption and effects. *Journal of Broadcasting & Electronic Media*, 47(2), 177–196. doi: 10.1207/s15506878jobem4702_2
- Hollweg, K. S., Taylor, J. R., Bybee, R. W., Marcinkowski, T. J., McBeth, W. C., & Zoido, P. (2011). *Developing a framework for assessing environmental literacy*. Washington, DC: North American Association for Environmental Education. <http://www.naaee.net>
- Huang, H. (2016). Media use, environmental beliefs, self-efficacy, and pro environmental behavior. *Journal of Business Research*, 69, 2206–2212. doi: 10.1016/j.jbusres.2015.12.031
- Hungerford, H. R., & Volk, T. L. (1990). Changing learner behavior through environmental education. *The Journal of Environmental Education*, 21(3), 8–21. doi: 10.1080/00958964.1990.10753743
- Huoponen, A. (2023). From concern to behavior: Barriers and enablers of adolescents' pro-environmental behavior in a school context. *Environmental Education Research*. doi: 10.1080/13504622.2023.2180374

- Jensen, B. B. (2002). Knowledge, action and pro-environmental behaviour. *Environmental Education Research*, 37(8), 1597–1613. doi: 10.1080/13504620220145474
- Kaiser, F. G., & Gutsher, H. (2003). The proposition of a general version of the theory of planned behavior: Predicting ecological behavior. *Journal of Applied Social Psychology*, 33(3), 586–603. doi: 10.1111/j.1559-1816.2003.tb01914.x
- Khalid, T. (2003). Pre-service high school teachers' perceptions of three environmental phenomena. *Environmental Education Research*, 9(1), 35–50. doi: 10.1080/13504620303466
- Knodel, J. (1993). The design and analysis of focus group studies: A practical approach. In D. L. Morgan (Ed.), *Successful focus groups: Advancing the state of the art* (pp. 35–50). Sage.
- Koskinen, S., & Paloniemi, R. (2010). Social learning processes of environmental policy. In J. Meijer & A. der Berg (Eds.), *Handbook of environmental policy* (pp. 291–308). Nova Science Publisher.
- Larson, L. R., Castelberry, S. B., & Green, G. T. (2010). Effects of an environmental education program on the environmental orientations of children from different gender, age, and ethnic groups. *Journal of Park and Recreation Administration*, 28(3), 95–113.
- Lee, K. (2010). The green purchase behavior of Hong Kong young consumers: The role of peer influence, local environmental involvement, and concrete environmental knowledge. *Journal of International Consumer Marketing*, 23(1), 21–44. doi: 10.1080/08961530.2011.524575
- Liang, S. W., Fang, W. T., Yeh, S. C., Liu, S. Y., Tsai, H. M., Chou, J. Y., & Ng, E. (2018). A nationwide survey evaluating the environmental literacy of undergraduate students in Taiwan. *Sustainability*, 10(6), 1–21. doi: 10.3390/su10061730
- Liu, S.-Y., Yeh, S.-C., Liang, S.-W., Fang, W.-T., & Tsai, H.-M. (2015). A national investigation of teachers' environmental literacy as a reference for promoting environmental education in Taiwan. *The Journal of Environmental Education*, 46(2), 114–132. doi: 10.1080/00958964.2014.999742
- Longhurst, R. (2016). Semi-structured interviews and focus groups. In N. Clifford, M. Cope, T. Gillespie, & S. French (Eds.), *Key methods in geography* (pp. 143–156). Sage Publications.
- Marquart-Pyatt, S. T. (2012). Contextual influences on environmental concerns cross nationally: A multilevel investigation. *Social Science Research*, 41(5), 1085–1099. doi: 10.1016/j.ssresearch.2012.04.003
- Michail, S., Stamou, A. G., & Stamou, G. P. (2007). Greek primary school teachers' understanding of current environmental issues: An exploration of their environmental knowledge and images of nature. *Science Education*, 91(2), 244–259. doi: 10.1002/sce.20185
- Miles, R., Harrison, L., & Cutter-Mackenzie, A. (2006). Teacher education: A diluted environmental education experience. *Australian Journal of Environmental Education*, 22(1), 49–59. doi: 10.1017/S0814062600001658
- Moseley, C. (2000). Teaching for environmental literacy. *The Clearing House*, 74(1), 23–24.
- Nagel, M. (2005). Constructing apathy: How environmentalism and environmental education may be fostering “Learned hopelessness” in children. *Australian Journal of Environmental Education*, 21, 75–80. doi: 10.1017/S0814062600000963

- Otto, S., Evans, G. W., Moon, M. J., & Kaiser, F. G. (2019). The development of children's environmental attitude and behavior. *Global Environmental Change*, 58. doi: 10.1016/j.gloenvcha.2019.101947
- Palmer, J. (1998). *Environmental education in the 21st century: Theory, practice, progress and promise*. Routledge, London and New York.
- Palmer, J. A., Suggate, J., Robottom, I., & Paul, H. (1999). Significant life experiences and formative influences on the development of adults' environmental awareness in the UK, Australia, and Canada. *Environmental Education Research*, 5(2), 181–200. doi: 10.1080/1350462990050205
- Parzonko, A. J., Balińska, A., & Sieczko, A. (2021). Pro-environmental behaviors of generation Z in the context of the concept of Homo Socio-Oeconomicus. *Energies*, 14(6). doi: 10.3390/en14061597
- Pedretti, E., & Nazir, J. (2014). Tensions and opportunities: A baseline study of teachers' views of environmental education. *International Journal of Environmental & Science Education*, 9, 265–283. doi: 10.12973/ijese.2014.215a
- Prabawa-Sear, K., & Baudains, C. (2011). Asking the participants: Students' views on their environmental attitudes, behaviours, motivators and barriers. *Australian Journal of Environmental Education*, 27(2), 219–228. doi: 10.1375/ajee.27.2.219
- Rees, J. H., Klug S., & Bamber, S. (2015). Guilty conscience: Motivating pro-environmental behavior by inducing negative moral emotions. *Climate change*, 130, 439–452. doi: 10.1007/s10584-014-1278-x
- Roberts, N. S. (2009). Impacts of the National Green Corps Program (EcoClubs) on students in India and their participation in environmental education activities. *Environmental Education Research*, 15(4), 443–464. doi: 10.1080/13504620902994127
- Robertson, C., & Krugly-Smolka, E. (1997). Gaps between advocated practices and teaching realities in environmental education. *Environmental Education Research*, 3(3), 311–322. doi: 10.1080/1350462970030305
- Roth, C. E. (1992). *Environmental literacy. Its roots, evolution and directions in the 1990s*. ERIC Clearinghouse for Science, Mathematics and Environmental Education, Columbus, Ohio.
- Salonen, A. O., Siirilä, J., & Valtonen, M. (2018). Sustainable living in Finland: Combating climate change in everyday life. *Sustainability*, 10(1). doi: 10.3390/su10010104
- Saylan, C., & Blumstein, D. (2011). *The failure of environmental education (and how we can fix it)*. University of California Press, Berkley.
- Schreier, M. (2012). *Qualitative content analysis in practice*. Sage publications.
- Smithson, J. (2000). Using and analysing focus groups: Limitations and possibilities. *International Journal of Social Research Methodology*, 3(2), 103–119.
- Sosu, E. M., McWilliam, A., & Gray, D. S. (2008). The complexities of teachers' commitment to environmental education. *Journal of Mixed Methods Research*, 2(2), 169–189. doi: 10.1177/1558689807313163
- Stake, R. E. (1994). Case studies. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 236–248). Sage Publications.
- Stern, P. C. (2000). Toward a coherent theory of environmentally significant behavior. *Journal of Social Issues*, 56(3), 407–424. doi: 10.1111/0022-4537.00175
- Stevenson, K., & Peterson, N. (2016). Motivating action through fostering climate change hope and concern and avoiding despair among adolescents. *Sustainability*, 8(1), 6. doi: 10.3390/su8010006

- Tuncer, G., Tekkaya, C., Sungur, S., Cakiroglu, J., Ertepinar, H., & Kaplowitz, M. (2009). Assessing pre-service teachers' environmental literacy in Turkey as a mean to develop teacher education program. *International Journal of Educational Development*, 29, 426–436. doi: 10.1016/j.ijedudev.2008.10.003
- UNESCO. (1977). *Intergovernmental Conference on Environmental Education organized by UNESCO in co-operation with UNEP Tbilisi (USSR) 1–26 October 1977. Final report*. <https://unesdoc.unesco.org/ark:/48223/pf00000032763>
- UNESCO. (2014). *Shaping the Future We Want. UN Decade of Education for Sustainable Development (2005–2014), Final report*. <https://sustainabledevelopment.un.org/content/documents/1682Shaping%20the%20future%20we%20want.pdf>
- UNESCO. (2019). *Educational content up close: Examining the learning dimensions of education for sustainable development and global citizenship education*. Paris.
- Wheaton, M., Kannan, A., & Ardoin, N. M. (2018). *Pathways in environmental literacy* (Environmental Literacy Brief, Vol. 2). Stanford, CA: Social Ecology Lab, Stanford University.
- Whitehouse, H. (2001). 'Not greenies' at school: Investigating the discourses of environmental activism in regional Australia. *Australian Journal of Environmental Education*, 30(1), 106–111. doi: 10.1017/S0814062600002469
- WSSC 2019. (n.d.). WSSC 2019. <https://www.enoprogramme.org/wssc-2019/>
- Yates, C., Partridge, H., & Bruce, C. (2012). Exploring information experiences through phenomenography. *Library and Information Research*, 112(36), 96–119. doi: 10.29173/lirg496
- Yin, R. K. (2014). *Case study research: Design and methods*. Sage.

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