Climate change education with a bright horizon?

Pedagogical reflections on teacher training for climate education that aims to empower students

Sheri Teal Willoughby Eklund
Climate change education with a bright horizon?

Pedagogical reflections on teacher training for climate education that aims to empower students

Sheri Teal Willoughby Eklund

Abstract

Climate change is already affecting communities around the world and the impacts will only get worse, according to scientists, unless we significantly reduce greenhouse gas emissions. These realities can lead to climate anxiety, not least among youth. How can teachers educate students about climate change in a constructive way? This study examines pedagogical reflections from grade school and gymnasium teachers who participated in a professional development workshop entitled “Climate workshop with a bright horizon” organized by The House of Science, the Bolin Center for Climate Research, and Stockholm City. To address students’ climate anxiety, research says that teaching methods characterized by pluralism, democratic participation, and authenticity can be empowering to students in helping them to engage, act, and cope with unpredictability. This study identifies opportunities to strengthen these aspects in climate education by, for example, using socio-scientific issue dialogues.

Keywords

Climate anxiety, climate change education, education for sustainable development, socio-scientific issues.
## Contents

**Introduction** ................................................................. 1  
**Background** ........................................................................ 2  
  Characteristics of ESD ............................................................ 2  
  Climate anxiety ..................................................................... 3  
  Climate teaching strategies: fact-based, normative and pluralistic ........................................ 5  
  Democratic working methods in the classroom .......................................................... 5  
  Authenticity and socio-scientific issues ......................................................... 6  
  Description of the workshop .................................................................. 7  
**Aim** ....................................................................................... 7  
**Methodology** ........................................................................ 8  
  Analytical methods ................................................................. 8  
  Participative observation .......................................................... 8  
  Focus groups .......................................................................... 8  
  Empirical-phenomenological analysis ...................................................... 9  
  Data collection and analysis .......................................................... 9  
  Reliability and validity ................................................................ 10  
  Ethical considerations .................................................................. 10  
**Analysis and Result** ................................................................. 11  
  Climate workshop with a bright horizon .................................................. 11  
  Lecture 1: “What drives the climate?” .............................................. 11  
  Lecture 2: “How do we reduce our impact on the climate?” .................. 11  
  Lab 1: “What drives the climate?” .................................................... 12  
  Lab 2: “How do we reduce our impact on the climate?” .......................... 12  
  Climate kit and teaching materials ....................................................... 13  
  Discussions and focus groups ........................................................... 13  
  Focus group dialogues ................................................................. 13  
  Selection from focus group dialogue and phrase analysis ...................... 14  
  Analysis of themes from both focus group dialogues .............................. 14  
  Categorization of themes based on research objectives .......................... 16  
  Workshop evaluation responses ......................................................... 17  
**Discussion** .............................................................................. 18  
  Teaching strategies in the workshop .................................................... 18  
  Fact-based strategy .................................................................... 18  
  Normative strategy ..................................................................... 19  
  Pluralistic strategy ...................................................................... 19
Democratic working methods ................................................................. 20
Authenticity .............................................................................................. 20
  Realistic and complex .......................................................................... 20
  Multi-disciplinary teaching ................................................................. 21
  Socio-scientific issues .......................................................................... 21
Summary .................................................................................................. 21
Limitations and suggestions ................................................................... 22
Conclusion .............................................................................................. 22
Reference List .......................................................................................... 23
Introduction

“Until you start focusing on what needs to be done rather than what is politically possible, there is no hope. … And if solutions within the system are so impossible to find, maybe we should change the system itself.”

- Greta Thunberg, 15-year-old from Stockholm at COP24 in Poland, December 2018 (Rigitano, 2018)

Fifteen-year-old Great Thunberg from Stockholm addresses representatives from 196 countries at the 24th Conference of the Parties of the Climate Change Convention (COP24) in Katowice, Poland. Is it just me who wonders how teachers might have influenced her?

Greta’s concern is about climate change, which is already affecting communities around the world in the form of extreme weather events, natural disasters, and melting of polar ice and glaciers. The impacts will only get worse, according to the Intergovernmental Panel on Climate Change (2018), unless we significantly reduce greenhouse gas emissions. While politicians and businesses can set targets to limit global warming, schools have a role to play in educating students about climate change. How climate change education is experienced is crucial to how students are able and willing to contribute to mitigating and adapting to climate change now and in the future.

Before entering Stockholm University’s bridging teacher education program, I worked with environmental organizations and businesses to identify opportunities and develop solutions to climate and energy issues. One of the main reasons I decided to become a teacher is to have the ability to contribute to students’ understanding and positive engagement around climate change issues. I chose to investigate climate change education for my thesis to increase my knowledge about teaching this subject in preparation for becoming a teacher.

The Swedish primary and secondary school curriculum addresses climate change as an aspect of sustainable development in its overall goals and in many different subject areas. Climate education is mentioned specifically in several of the course syllabuses. For example, the science syllabus for grades seven to nine includes learning about the greenhouse effect, energy use, and climate change. In gymnasium (upper secondary school), students learn about the impact of climate change for people, society and the environment (Skolverket, 2018).

In addition, the environmental perspective is part of the fundamental values and tasks of the school. The Swedish grade school curriculum states:

> An environmental perspective provides opportunities not only to take responsibility for the environment in areas where [students] themselves can exercise direct influence, but also to form a personal position with respect to overarching and global environmental issues. Teaching should illuminate how the functions of society and our ways of living and working can best be adapted to create sustainable development (Skolverket, 2018, p.8).

However, climate change education poses challenges for teachers and students that Kronlid (2010, p.18–20) describes as a climate didactic triangle. These challenges are value conflicts, knowledge uncertainties, and political and scientific controversies. Value conflicts occur between the different needs and interests of those contributing to climate change and those who suffer as a result. Controversies include how to handle climate change politically when so many interest groups are
impacted. Climate science has also developed amid scientific controversy and debate, for example, about human’s role in climate change. The science around climate change still leaves much unpredictability regarding time, place and nature of impacts. Kronlid suggests that including one or more of these aspects in climate lessons can help students to understand and critically reflect on the complexity of climate change.

In addition to didactic challenges, climate change poses a threat to the status quo which can result in people experiencing so-called climate anxiety. This can be related to concerns about changing our lifestyle to prevent further climate change. It can also be a result of feared or actual climate change impacts. Climate anxiety can also be related to guilt about global warming and its impacts that our own consumption, traveling, and lifestyles cause.

The House of Science, the Bolin Center for Climate Research, and the Education Department of Stockholm City organized a professional development workshop for teachers to provide information and materials to support climate change education. With funding from FORMAS, the workshop aimed to address climate anxiety “by shifting the focus to a brighter, more empowered horizon where we better understand climate change and what solutions are available” (House of Science, 2018).

This study examines participating teachers’ pedagogical reflections on the “Climate workshop with a bright horizon.” The research questions investigated in this study are:

- What are teachers’ reflections after attending a professional development workshop about climate education that is said to offer a “bright horizon?”
- What opportunities emerge for developing climate education based on teaching methods that research says can address students’ climate anxiety?

Background

The background section introduces some relevant concepts from the wide body of research about education for sustainable development (ESD) and climate education specifically. Based on research on climate anxiety, several characteristics of ESD are highlighted that research says can increase students’ sense of empowerment and ability to engage to address climate change. These are pluralistic, democratic, and authentic teaching methods. This section also describes engaging students in real-world problems through socio-scientific issues based instruction that investigates authentic scientific issues with ethical and societal implications.

Characteristics of ESD

Following the United Nations meeting on Sustainable Development in Johannesburg in 2002, the Swedish government formed a committee of experts to examine the Swedish school system and propose recommendations for ESD in Sweden. According to the committee, the aim of ESD is “to empower students with the ability and the desire to work towards achieving sustainable development locally and globally” (SOU, 2004, p.22). The knowledge, capacity and will to act is called action competence.
Given that purpose, the report describes the following as desirable characteristics for ESD:

- Many multifaceted illustrations of economic, social and environmental conditions and processes should be dealt with in an integrated manner by using interdisciplinary working methods.
- Conflicting objectives and synergies between different needs and interests should be clarified.
- Content should have a long-term perspective extending from the past to the future, from the global to the local.
- Democratic working methods should be used so that students can influence the design and content of educational programs.
- Learning should be reality-based with close and frequent contact with nature and society.
- Learning should focus on problem solving and stimulate critical thinking and readiness to act.
- Both the process and the product of education are important (SOU, 2004, p.22-23).

A similar list of features was put forward for the UN’s Decade of ESD by UNESCO (2006, p.17): interdisciplinary and holistic, values-driven, critical thinking and problem solving, multi-method, participatory decision-making, applicability in personal and professional life, and locally relevant.

More recently, the Swedish Agency for Education put forward the following goals for ESD:

- Strengthens democratic working methods that give students opportunity for participation and influence,
- Develops a critical approach, reflection around values, local and global perspectives, and
- Leaves room for cross-disciplinary cooperation and a diversity of pedagogic methods (Caiman, et al., 2018, p.12, my translation).

These characteristics and goals provide a useful framework for comparing educational and psychological research on addressing climate anxiety. While all characteristics mentioned above are important for ESD, increasing action competence to address climate anxiety leads to an emphasis on pluralistic, democratic and authentic teaching methods, as explained in the following sections.

**Climate anxiety**

According to Mattlar (2010, p.94-95), climate anxiety stems from one’s realization of the serious negative impact on the climate of our consumption patterns and societal structures. This can lead to individuals feeling overwhelmed over their role and responsibility for climate change impacts, compensating for damage, and changing their lifestyle. Kramming (2017, p.204) describes the anxiety as cognitive dissonance between what one knows one should do and what one is doing. This can lead one to feel powerless, hopeless and melancholy. Ojala’s research (2007) examined the nature of environmental worry and concluded that there is a complex relationship between worry and well-being that is dependent on other factors relating to how one copes with worry. This and other research related to climate anxiety and recommendations relevant to climate education follow.

Anxiety about environmental issues and climate change are real and “should be taken seriously,” according to Ojala (2007, p.116). Ojala investigates what factors contribute to whether this anxiety leads to hopelessness and inaction or to environmentally-friendly behaviors and social engagement that improves well-being. The factors that determine these opposite outcomes involve the ability to articulate emotions and learn ways to deal constructively with them. Well-being is correlated with
trust in one’s own ability to contribute to the solution as well as trust in other actors such as environmental organizations (Ojala, 2007, p.116). Her study recommends an authentic teaching approach that includes dialogue based on the students’ own experiences. Democratic working methods in the classroom are also important so students can practice using their influence and be better prepared to engage in society as well.

How climate change is taught can therefore have an impact on how students deal with worry about climate change. According to Lundegård (2018, p.8), young people bear a disproportionate amount of guilt over how they live. Therefore, the school does not need to burden students with additional guilt about climate change even if climate change education enables students to reflect on their own impact. However, action competence is not primarily about adopting certain environmentally-friendly behaviors, he argues, but being able to look at the problem from different perspectives to see different solutions and decide what to do (Lundegård, 2018, p.9). His research points toward pluralism and democratic methods when teaching about sustainable development.

Kramming’s study (2017) of Swedish gymnasium students found that students were mostly negative about the future regarding society moving toward environmental collapse or sustainability. This was partly blamed on ESD being overly normative or prescriptive about “right” attitudes’ and behaviors’ importance in solving environmental issues. Because “right” behaviors are not always followed by the students for various reasons, negative feelings and ambivalence about the environment resulted. Her recommendation is to “expose young people to a dynamic and contextualized content of ESD based on systemic and complicated models of thinking” to give rise to new opportunities and counteract the negativity students expressed regarding environmental issues (Kramming, 2017, p.212). Her study points to authentic methods that take account of the complex, interrelated and cross-disciplinary nature of environmental issues and solutions.

Addressing anxiety and powerlessness over the future in the face of climate change can take the form of health education with a focus on climate change. To increase students’ sense of empowerment, Kronlid (2010, p.75-80) recommends a pluralistic teaching method that increases students’ experience of participation, influence and codetermination. This can include dialogue-based methods, a democratic classroom where students have a voice, and lessons that incorporate students’ own experiences. Finally, students should be given the opportunity to reflect over lifestyle changes that may be needed to reduce impacts to the climate and how those are tied to health and ethical concepts such as human rights and solidarity. Taken together, these recommendations emphasize democratic, pluralistic and cross-disciplinary teaching approaches.

In summary, these studies point to teaching methods that increase students action competence to address climate anxiety. When comparing the characteristics of ESD with the literature on climate anxiety, a subset of the teaching methods seems most advantageous. These characteristics are grouped under the following three labels/descriptions that are explained in more detail shortly and will reoccur throughout the study:

- **Pluralistic** (dialogue-based methods that include multiple diverse perspectives),
- **Democratic** (students are active and have influence in the learning process),
- and **Authentic** (involving real-life, complex and cross-disciplinary situations).
Climate teaching strategies: fact-based, normative and pluralistic

Researchers investigating environmental education have observed three different approaches or strategies used in environmental education: fact-based, normative, and pluralistic teaching strategies, described below. These strategies differ on educational philosophies of students experiencing learning content or receiving it from the teacher. They also differ on a view of environmental issues as specified by experts or defined by different human and ethical interests (Kronlid, 2010, p.148-155; Lundegård, 2018, p.10).

Fact-based. A premise of fact-based teaching is that there is one correct set of facts, in this case developed by scientists. This strategy emphasizes teaching about the scientific fundamentals including well-established climate research. This could include lessons about the atmosphere’s composition, the greenhouse effect, the carbon cycle, rising carbon dioxide levels and rising average global temperature. The benefit of this strategy is it fits nicely with what science teachers are often most comfortable with – teaching science. One drawback is that it can feel quite distant from the individual, for example, what they can do about the changing climate or how it might affect them. Also, in focusing on well-established science, the fact-based approach may not address scientific unpredictability with regards to impacts of climate change.

Normative. The normative strategy aims to develop “good” environmental values and behaviors as determined by experts or scientists. These values and behaviors are one aspect of the school’s role in developing “good” citizens. An advantage of this strategy is students can be engaged personally. Furthermore, research shows that environmentally friendly attitudes and behaviors developed by students often are maintained in adulthood. The disadvantage of this approach is it can tend toward a list of good and bad behaviors without providing the students sufficient tools to critically address new problems and choices that may arise. While the Swedish school curriculum gives schools a mandate to establish norms and values, research on ESD tends to be critical of the normative approach as overly one-dimensional and undemocratic.

Pluralistic. In the pluralistic strategy the focus is understanding the perspectives of different interest groups and how that might affect their motivations and actions. In this case there can be many “right” answers depending on what perspective one takes. This method has the benefit of encouraging the students to think critically and question old “truths.” A diversity of perspectives creates space for new ideas and solutions. However, pluralistic education takes time. Another drawback is that not all interest groups have equally solid arguments, and it is important for the teacher to not create an “anything goes” atmosphere of relativism. For that reason, a strong factual basis and a well-informed teacher are advantageous for a successful pluralistic debate or discussion.

Pluralism is recommended for ESD because it engages students in considering different aspects and opinions in developing and arguing for their own standpoints. It is also complimentary to democratic working methods.

Democratic working methods in the classroom

Democracy and sustainable development are not automatic allies. In other words, everyone democratically championing their own needs and desires does not lead to a sustainable outcome, rather a tragedy of the commons. On the other hand, forcing everyone to act sustainably would be
authoritarian and undemocratic (Van Poeck & Vandenabeele, 2011). This seeming paradox is partially resolved through applying democratic working methods to ESD, which can result in a diversity of solutions that, through negotiation and compromise, can accommodate a wide range of interests. Stated more emphatically, Fritzén and Gustafsson (2004) write, “Sustainable development will not become democratic knowledge until classrooms can create the necessary conditions for democratic action” (p.11).

Both democracy and sustainable development are promoted in the Swedish school curriculum. Regarding democracy, the Swedish curriculum states:

It is not in itself sufficient that teaching only imparts knowledge about fundamental democratic values. Democratic working forms should also be applied in practice and prepare pupils for active participation in the life of society. This should develop their ability to take personal responsibility. By taking part in the planning and evaluation of their daily teaching, and being able to choose courses, subjects, themes and activities, pupils will develop their ability to exercise influence and take responsibility (Skolverket, 2018, p.7).

According to the Swedish government’s committee for ESD (SOU, 2004), students need to understand why they are learning about sustainable development and feel a part of the process. Democratic working methods have the advantage of high student participation which can lead to greater motivation. The learning should be built on a shared conversation between the teacher and the students. As students “participate in their own learning, they have influence over the learning process and thereby get used to handling one of the most important skills to contribute to sustainable development” (SOU, 2004, p.67, my translation).

In addition to democratic participation, understanding the political context for climate decisions can be an aim of climate education. Democratic climate competence involves learning how to engage and influence decision-making. As opposed to frightening students with doomsday warnings that can lead to hopelessness and despondency, Håkansson (2010, p.102-103) lifts the importance of the teacher to maintain optimism in the ability of individuals to make a difference. The teacher’s way to talk about climate change can influence students’ motivation to engage.

**Authenticity and socio-scientific issues**

In addition to pluralism and democratic working methods, authentic or realistic learning is an important aspect of ESD that can also address students’ sense of empowerment for navigating real world issues. Caiman et al. (2018, p.3) describes an authentic issue as one that is relevant and interesting to students. In this study, “authentic” also implies what Kramming (2017, p.212) describes as “a dynamic and contextualized content of ESD based on systemic and complicated models of thinking.” In other words, an authentic approach is realistic, relevant, complex, integrated, and interdisciplinary.

Teaching approaches that explore authentic, complex, and cross-disciplinary problems can be coupled to research on socio-scientific issues (SSI) based instruction (Presley, et al., 2013). Teaching with SSI involves exploring authentic societal issues with a scientific base that can capture students interest due to the issues’ relevancy or reporting in the media. Students develop knowledge and skills to meet complex, controversial issues in the real world that have no “right” answer. Such skills include seeking information and determining the reliability of information sources. Students can also learn to distinguish between fact-based and values-based arguments in communicating about different standpoints. Students take an active role in determining what information they need and making their
own investigations with support of the teacher. In this way, they can feel more empowered over their own learning (Ekborg et al., 2017, p.23-26).

Many aspects of climate change can be explored in the classroom using SSI, to name a few examples: What sources of energy should we use? What types of transportation infrastructure should be built? How should our food be produced? What should we eat? What should be done about buildings in flood or wildfire zones?

In summary, using pluralistic, democratic and authentic teaching approaches in climate education is recommended to increase students’ action competence and address climate anxiety. These approaches offer different focuses but are more complimentary and overlapping than distinct from each other. SSI-based instruction, for example, combines all three of these characteristics.

**Description of the workshop**

To support teachers in educating students about climate change, The House of Science, the Bolin Center and Stockholm City created a professional development workshop for middle to upper secondary school teachers. Here is how the workshop was described on the announcement:

**Climate Workshop with a bright horizon**

Today, many of us live with climate anxiety and the climate issue is to be taken seriously. However, when the future is often painted in dark colors, we risk giving up and wavering instead of contributing to change.

The Bolin Center for Climate Research, House of Science and Stockholm City wish to support you as a teacher by shifting the focus to a brighter, more empowered horizon where we better understand climate change and what solutions are available. At the Bolin Center for Climate Research, where SU, KTH and SMHI's climate researchers gather, there is climate competence from several disciplines. Now this knowledge bank is available through full day training for you as a teacher.

Content:

- Free full day training including a climate kit, tutorials and educational materials
- Morning - we learn more about climate and climate change during lectures and laboratory sessions
- Question time where you as a teacher can ask your and students' climate questions directly to climate researchers
- Lunch - we treat
- Afternoon - lecture and activity where we focus on what we can do

(House of Science, 2018, my translation)

**Aim**

The aim of this study is to contribute to research on climate change education by investigating teachers’ pedagogical reflections after participating in the professional development workshop “Climate workshop with a bright horizon.” The study also investigates teachers’ reflections regarding the workshop’s goal to address students’ climate anxiety and increase hope and engagement regarding climate change.
Furthermore, the study aims to provide the organizers of the workshop with ideas for developing future teacher trainings about climate change education that can address students’ climate anxiety based on reflections from the participants and insights from previous research. These ideas can also inform and inspire teachers in planning climate change lessons.

**Research questions, refined based on literature review:**

- How do teachers discuss using information and materials from a professional development workshop about climate education in their own classrooms? What didactical content, methods and purposes are stated or inferred?

- In the workshop and in the focus group dialogues, what emphasis is placed on pluralistic, democratic, and authentic teaching methods, which emerged as important characteristics for ESD and addressing climate anxiety in the literature review?

- What opportunities emerge for developing future climate workshops for teachers that can further increase students’ action competence to constructively address students’ climate anxiety?

**Methodology**

To answer the research questions, qualitative and quantitative data collection and analyzation methods were used. In this section, general theory for the analytical methods and how those methods were applied for the study is explained. Finally, reliability and validity of the methodology and ethical considerations are discussed.

**Analytical methods**

Participative observation, focus groups, and empirical-phenomenological analysis, described below, were the main analytical methods used to implement the study.

**Participative observation**

Originating in anthropological and sociological research, participative observation allows the researcher to come close to the research subjects and share in their experiences while also studying them. The advantage of this method is firsthand experience which can improve understanding of the context and interpretation of observations. This leads to richer data material than, for example, the interview method. On the other hand, the double role of participant and observer can create ethical dilemmas. Confidentiality and agreement to participate in the research are therefore important ethical measures (Fangen, 2005).

**Focus groups**

Focus groups for social research purposes involves organizing a group of people to talk about a specific subject for a limited time. The discussion can be more or less structured, but unlike an interview, the participants are mainly discussing the topic with each other and not the researcher. The discussion is influenced by the group dynamic and interpersonal factors, which can be an interesting part of the result. The focus group is usually recorded and transcribed to aid analysis (Wibeck, 2010).
Empirical-phenomenological analysis

Empirical-phenomenological analysis describes people’s experiences to support a qualitative research process (Christensen, 2017, p.81). A specific method for this analysis is called “Phrase-concentration.” Kvale’s phrase concentration method has five steps. First, read the whole interview text to get a feeling of what was said. Second, divide the text into phrases or “units of meaning.” Third, formulate as simply as possible a dominant theme of the phrase as from the interviewees’ perspective and without judgment from the researcher. Fourth, ask what that theme says with respect to the purpose of the research. Fifth, tie the themes together in a descriptive statement related to the researcher’s purpose (Kvale, 1997, p.175-178). The findings can carry truths and insights that are transferable to others.

Data collection and analysis

On October 19, 2018, I met with one of the workshop organizers to get a preview of the climate kit and what would happen in the workshop. This allowed me to begin to formulate my study questions.

On November 13-14, 2018, I participated in “Climate workshop with a bright horizon” (“Klimatfortbildning med ljus horisont”) professional development course for teachers (House of Science, 2018). The first day was aimed to teachers for students from 13 to 19 years old; the second day for teachers of students from 10 to 15 years old. Both took place on the campus of Stockholm University.

During the courses I participated and observed using the “participative observation” method as described by Fangen (2005). I took brief notes on the teachers’ behaviors during the different lectures and activities. For example, I noted if they were listening quietly, asking questions, taking notes, talking with each other, etc. These observations were used primarily to provide context to the focus group conversations that came later.

After the workshops, I led focus groups with four to five teachers who participated that day. As discussed in Wibeck (2010), focus group discussions were semi-structured and focused on how the teachers thought they would use what they had learned in the workshop in their own classrooms. The discussions were recorded and lasted about 30-35 minutes.

To complement the qualitative results, I added two questions to the workshop evaluation that teachers were requested to complete after the workshop. The first question was about the teachers self-described experience level for teaching about climate change. The other question asked which activities from the workshop were most valuable to their climate lessons. This allowed me to compare what I heard in the focus groups to what the wider group of participants thought was most valuable from the day. The evaluation also captured information on grade-level and if the teachers were likely to use the workshop materials for inter-disciplinary teaching. This allowed me to analyze other factors that could contribute to which activities the teachers thought were most valuable.

I transcribed the focus group discussions in their entirety with nearly all identifiable words and sentences included, but not tone, gestures, etc. This level of transcription captured the main point of what was said, which I judged, in accordance with Wibeck (2010, p.95-96) was sufficient for further analysis.

I analyzed the focus group discussions using a variant of the empirical-phenomenological analysis phrase concentration method described by Kvale (1997, p.175-178) to identify themes in the
discussion. From these themes I determined what didactic questions the teachers were answering, for example, what, how, and why they might use the workshop materials to teach about climate change.

I then compared the results of the qualitative and quantitative analyses to different theoretical frameworks from the literature. In particular, I looked for evidence of fact-based, normative and pluralistic teaching strategies; democratic working methods; authentic issues; and reflections about climate anxiety.

**Reliability and validity**

Given this investigation method, some challenges to the reliability and validity of the data and analysis arise.

Willingness to participate in a full-day workshop and spend additional time after the workshop to participate in the focus group can signal heightened interest in climate issues. Therefore, the types of discussions had with these teachers is not considered generalizable to other groups of teachers. However, collecting teachers’ recommendations, best practices and challenges with climate lessons was of interest to this study to inspire other teachers and provide feedback to the workshop organizers. Therefore, it could be considered an advantage that the teachers interviewed were engaged and experienced in teaching about climate change.

Regarding the quantitative data, twenty of forty teachers filled out the online evaluation. Therefore, the sample size was too small and non-random to draw statistically significant conclusions. However, with half of the participants responding, some useful general indications and comparisons could be drawn.

In addition to data validity, the impact of the researcher’s judgments and opinions are a challenge regarding the data analysis. According to Kvale (1997, p. 149), the transcription of the focus group discussion is not the primary data, but a construction of the researcher. Not all information, utterances, tone, body language, etc. are captured in the transcription, and therefore the researcher has made a judgement about what to include and exclude. Translating the discussions from Swedish to English added another level of distance from the original empirical data. Returning to the original recordings during the analysis process gave more assurance that the interviewees’ original meaning was captured. However, analyzing workshop observations and the transcriptions to determine didactic reasoning was again a subjective process.

**Ethical considerations**

During the introductions at the beginning of the workshop, I introduced myself to the whole group as both a participant and a student researcher who is making observations for my study. In accordance with research ethics guidelines described by Eriksson (2018), all focus group participants were given a release form where I explained my study, how the recordings would be used and then disposed, and that their names and schools would not be used in my paper. All focus group participants signed the release form before we began. For the online evaluation that the teachers completed after the workshop, teachers were given the option to have their responses shared with me or not. All teachers that filled out the evaluation agreed to have their responses shared with me.
Analysis and Result

Observations from the workshop, the qualitative results of the focus groups, and the quantitative results from the workshop evaluation are described in this section.

**Climate workshop with a bright horizon**

This section describes the content and teaching methods of the professional development workshop entitled “Climate workshop with a bright horizon,” the subject of this study. The first workshop took place November 13, 2018 and targeted teachers with students aged 13 to 19 years old. The second workshop on November 14, 2018 targeted teachers with students ages 10 to 15 years old.

The agenda for the two workshops was nearly identical. The day started with the organizers introducing themselves and then a round of quick introductions from all the participants. There were 25 active teachers on the first day plus myself and another researcher; on the second day there were 15 active teachers plus myself. Here I briefly describe the different parts of the workshop and analyze them based on the relevant teaching approaches and characteristics of ESD described in the background.

**Lecture 1: “What drives the climate?”**

The first lecture “What drives the climate?” was delivered by a geology professor. This lecture was meant not only to inform the teachers, but also provide the teachers a ready-made power point presentation that they could use with their students. In the lecture, the professor described four drivers of climate: the sun, albedo (planet’s reflectivity), the greenhouse effect, and weathering of rock.

In addition to the geologic perspective, the lecturer talked about how Sweden’s carbon emissions have changed in recent years. Within Sweden emissions have gone down. However, emissions in other countries attributed to Swedish consumption have increased. The net result is a stabilization of emissions, which is a slight decrease from the projected emissions since 2005. The professor suggested that this emissions stabilization and potential for further reductions can be a source of hope regarding what is attainable by other countries and globally.

*Analysis:* This lecture emphasized climate science was fact-based and authentic. Time perspectives and complexity were emphasized. The lecture maintained an optimistic tone about how individual actions do make a difference.

**Lecture 2: “How do we reduce our impact on the climate?”**

A professor of chemical meteorology delivered the second lecture, “How do we reduce our impact on the climate?” He discussed our rapid development over the past hundred years. He made the point that what we consider as “normal” now has not been “normal” for very long. Rapid change in, for example, transportation and food production, has occurred before and can occur again. He asked participants to guess how much carbon is emitted in producing a latte, flying to Thailand, and other products and activities. He discussed an exercise that students can do to consider different levels of impact and influence: “me, us, and them.” The idea is to consider actions the individual can do to reduce their carbon emissions (me), actions where the individual can join with others in their class or
family, for example, to reduce their impact (us), and then what individuals need to ask politicians and business leaders to do (them).

In both lectures, teachers participated by answering questions posed by the professors, occasionally taking notes, and asking questions or making comments.

Analysis: In emphasizing behavior change, Lecture 2 was normative. It was authentic regarding the integrated and interdisciplinary nature of climate change. It provided different timeframes and local/global perspectives. It sought to increase action competence by maintaining an optimism about what could be accomplished by individuals and society.

Lab 1: “What drives the climate?”

In the first lab activity, “What drives the climate?” participants observe the effect of CO2 on the rate of temperature increase. To achieve this, two glass jars are equipped with a thermometer inside. In one jar a vitamin tablet is dissolved which releases CO2 into the jar. The other jar has air from the classroom. The two jars are placed equally distant from a heat lamp. The temperature is read by the students every 30 seconds for ten minutes. The temperature inside the jar containing more CO2 should rise faster and be hotter than the jar containing regular air. The participants were divided into smaller groups to test the experiment. According to the professor, there are sources of error in the lab that can create different results. The professor and participants talked about these challenges and potential ways to limit the sources of error. The professor also gave instructions for a modification of the lab that would test the effect of albedo on rate of temperature increase.

Analysis: This lab emphasized climate science and was fact-based. Although the set-up was a simplification of reality, it was authentic in demonstrating the complexity of systems particularly regarding sources of error. The lab was hands-on and participatory.

Lab 2: “How do we reduce our impact on the climate?”

The final activity was called “How do we reduce our impact on the climate?” It comprised of four activity stations: clothes, food, transportation, and electronics/energy use. The idea was to do the activities in small groups and discuss which choices result in the highest and lowest carbon emissions. For example, in the clothes activity, participants were assigned to be a “climate hero” or a “climate villain” and then asked to choose a garment that would result in the least or the most carbon emissions, respectively. They could choose from clothes purchased second-hand, from an eco-boutique, handed down from a neighbor, from a luxury store, or from a discount store. Each was made of different materials in different places and used for different purposes. That gave the opportunity to consider many aspects of the garments’ lifecycle and carbon emissions. The food, transport and energy use stations had different instructions and materials but similar levels of complexity.

While there was expected to be a “right” answer for the activities, other answers could be “right” if justified with a good argument. There is a lot of complexity and even other factors that one must consider besides carbon emissions in making choices in this activity. This led to many questions and suggestions during the discussions.

Analysis: This activity focused on changing behavior and was therefore normative. It was authentic in addressing real-life choices. This led to discussions of complexity that spanned across disciplines. It was hands-on and participatory. While the goal is to change behaviors to reduce carbon emissions, the activity recognized that different people will find different ways to do this, and in that sense the activity was democratic.
Climate kit and teaching materials

The teachers received a “climate kit” with all the materials from the two lab activities to take back to their schools and use with their students. They also received all the slides, background materials and information about additional resources that were mentioned during the day. The workshop thereby equipped the teachers with information, materials and the experience of doing the activities themselves so they could incorporate what they learned in the workshop into their own climate lessons.

Discussions and focus groups

Apart from the organized activities, there were two coffee breaks and a lunch break during which teachers could talk with each other. Teachers that came from the same school tended to talk to each other during these breaks. Teachers that came by themselves sometimes talked to others and sometimes stood by themselves. During these breaks I talked to several different teachers about their climate teaching experience and their thoughts on the workshop activities. While the workshop’s written agenda included a concluding discussion at the end, that time was used to discuss the second lab activity instead. Finally, I led focus groups with four to five volunteer participants after the last session on both days.

Focus group dialogues

The focus group on the first day had five participants: three gymnasium teachers (students aged 16-19) and two grade 7-9 teachers (students aged 13-15). These teachers all taught one or more scientific subjects (e.g., chemistry, biology) and one taught math as well. One taught at an international school that does not follow the Swedish curriculum.

The focus group on the second day had four participants: one gymnasium teacher (students aged 16-19), one grade 4-6 teacher (students aged 10-12), a teacher who taught ages 6 to 12, and a teacher who taught ages 6 to 15. The teachers taught science and at least one other subject. Two teachers also specialized in outdoor education.

Both focus groups began with me introducing the purpose of the study and how the recordings from the discussion would be used. Then the teachers introduced themselves and gave a brief description of how they work with climate education.

The discussion kicked off with the question, “Was there something you took away from the first lecture that you would like to use in your classroom? And if so, how?” We continued through the workshop agenda, the conversation weaving between thoughts about the workshop, stories from teachers’ experiences, and ideas and opinions regarding climate education. Given the workshop title “Climate workshop with a bright horizon,” I asked the participants what “bright horizon” means to them and how that impacts their climate lessons. To finish, I asked what was most valuable from the day. Both focus group discussions lasted just over thirty minutes.

The focus group results and analysis are presented in three sections. The first section provides a selection from the focus group dialogue and shows how themes from the conversation were analyzed using empirical-phenomenological analysis phrase-concentration method in Table 1. In the second section, examples of teachers’ ideas for using the climate workshop materials in their climate lessons are described. Additionally, I list themes about what is important to the teachers and what challenges they face. In the third section, Table 2 relates what was said by the teachers to the characteristics of ESD mentioned in the literature review.
Selection from focus group dialogue and phrase analysis

Here is an example of using the empirical-phenomenological analysis phrase-concentration method on a section of the focus group dialogue with secondary school teachers. In the first column below, I have translated the transcription from Swedish to English. In the second column below, I formulate a theme of the phrase from the interviewee’s perspective.

Table 1: Selection from focus group and phrase-concentration analysis examples

<table>
<thead>
<tr>
<th>Selection from focus group transcript (my translation)</th>
<th>Paraphrasing of meaning relevant to study</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Teacher 1</em>: One part is clear -- to provide knowledge and begin reflecting. But you also <strong>feel you have the mandate to influence the next generation</strong>. It feels sometimes that you get them to understand what is good. <strong>But how do you get them to apply that</strong>, like to begin? Like it is good to buy secondhand clothes. But how many are prepared to do that? No one. It is good to eat less meat. But how many are prepared to do that? No one raises a hand. I ask how many in the classroom have ever bought secondhand clothes? In nearly all my classes almost no one raises a hand. And there are other aspects that maybe I have thought about myself – they think it is gross. And I’ve raised, how many have slept at a hotel before? Everyone raises their hands. How many have slept in that bed? (laugh) Right. <strong>You have to think up that kind of stuff all the time to possibly, in some way, get them to…</strong></td>
<td></td>
</tr>
<tr>
<td><em>Teacher 2</em>: …<strong>You can actually assign behavior changes</strong>, not just ask if you could imagine doing this like a hypothetical question. Now you get the assignment to, under two weeks’ time, you will…</td>
<td></td>
</tr>
<tr>
<td><em>Teacher 3</em>: Yes, you begin with theory and <strong>those bags [representing CO2 emissions from Lab 2] are very concrete</strong> and good. <strong>I think it is very important that they get to choose</strong>. Not that you assign behavior changes, but that they choose like – OK; what do you know now? You know that these clothes cost that much CO2. And those cost that much. What could you plan… for a limited time?</td>
<td></td>
</tr>
</tbody>
</table>

Analysis of themes from both focus group dialogues

The above was a sampling from a focus group. When looking at the focus group dialogues in their entirety, the teachers discussed different ideas for using workshop materials. Themes emerged on what is important to some teachers, and what is challenging. These ideas and themes are described below.

Ideas for climate lessons and using workshop materials

Most of the teachers discussed using the lecture information and doing the lab activities with their students. Here were some specific ideas different teachers had:

- Use lecture slides as an introduction to a cross-disciplinary project which is to make a building that can withstand natural disasters linked to climate change
- Begin with a diagram from Lecture 1 to show the importance of what we do in Sweden to the global CO2 emissions
- Do Lab 1 with teacher’s own classes and then with other classes during a climate theme day
- Use Lab 2 to spark discussions with students
- Use Lab 2 for students to investigate their own impact and ways to reduce their own carbon emissions
- Use lecture slides and labs from the workshop during a climate theme day and invite a speaker

**Important themes from teachers’ discussions**

Recurring themes or longer discussions around a theme were deemed to be important to at least some of the teachers. These include the following:

- Know and adopt “right” behaviors – less meat, less waste, fly less, drive less, write to local politicians
- Influence family, school leadership, and the local politicians to protect the environment via the students
- Knowledge base important so students can make better decisions
- Multi-disciplinary aspect – big picture, everything is connected, integration across subjects
- Learning from nature – be out in nature, not scared of nature
- Start discussions around complex issues with students - “right” answer not necessary
- Emotional aspects – fun, motivated, relaxed, positive, calm, not depressed
- Integrity – students shouldn’t be misled by teacher overemphasizing the positive aspects
- Student participation – students have a choice in the activity they do
- Information and activities at the students’ level
- Structure – for example, the logical structure of the slides, and the workshop’s balance between theory and practice
- Ready-to-use activity kit that they can keep

**Challenges noted by the teachers**

The following challenges for using workshop materials or for climate lessons in general were raised by at least one teacher.

Challenges for using the workshop materials:

- Relating the different time perspectives (e.g., geologic, modern) without confusing or misleading students
- Questions about science behind Lab 1
- Limited time in class syllabus to add workshop activities

Challenges for climate lessons in general:

- How to change our lifestyles when we’re so comfortable
- Kids in virtual/game world instead of out in nature
- Limited time to cover all they want in the lessons, also for planning lessons
Categorization of themes based on research objectives

After compiling themes from the focus groups, I evaluated which themes were relevant to the research questions. In Table 3, I list a sampling of quotes from teachers from different moments during the focus group conversations that are relevant to fact-based, normative or pluralistic teaching strategies, democratic and authentic working methods, or climate anxiety / bright horizon. Some quotes were relevant in more than one area. Therefore, it required the context of the whole conversation to draw my conclusions in the next section.

Table 3: Teaching strategies and characteristics paired with a sampling of relevant quotes from teachers in the focus groups

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Relevant quotes from different teachers (my translation)</th>
</tr>
</thead>
</table>
| Fact-based teaching strategy | - Need facts first to have something to stand on  
- Give fact base first as an introduction to the project  
- I like the hands-on science. At the same time, I need the theoretical background. I believe I got both today. |
| Normative teaching strategy | - We have a duty to influence the next generation – not only to understand what is good – but to apply it.  
- The climate project shouldn’t be a hyped thing that they work on for a while and then drop - it should continue.  
- They need to see kids their own age who make changes. And we need to know about these examples so we can show them. |
| Pluralistic teaching strategy | - It’s about different economic interests.  
- We discuss what they think about sustainable development.  
- It depends on what bubble you live in – like now everyone is vegan. Yes, there are more vegetarians and vegans, but we eat more meat today than ever. |
| Democratic working methods | - I strongly think they must choose their own environmental behavior change to try out.  
- Once we have educated our youth, they are going to make demands of society, I hope.  
- It was the youth council that came with the suggestion for vegetarian lunch day to the local government. |
| Authentic (Realistic/Integrated/Interdisciplinary) | - They must get to work with their hands and build.  
- The problem is so complex – there isn’t a right answer – just that you spark questions.  
- Later when they put on their economist clothes they are ready to tackle climate issues in that role also.  
- We are out in nature and teach all the subjects because everything hangs together. |
| Climate anxiety / bright horizon | - Important to highlight what is positive with what we do instead of laying guilt on everything.  
- But we can’t be so positive that students feel we’re trying to trick them to not be afraid.  
- We can all do something. And if we all do a little, it adds up.  
- There is too much focus on climate anxiety instead of focusing on that we can actually do something about it.  
- We are lucky that can help students. It’s a bright horizon because they can drive something. |
Workshop evaluation responses

Twenty out of forty teacher participants filled out the online workshop evaluation. In the workshop evaluation, teachers rated the usefulness of the lectures and lab activities in their classrooms on a scale from one (not useful) to five (very useful). Overall, the teachers rated the workshop 4.75 of 5, showing a high level of satisfaction with the workshop and materials. Each individual activity also received high scores (4.3 or greater of 5), which was a very positive result, but made it hard to compare the activities.

Therefore, another question on the evaluation was: “Which part of the workshop seems most valuable for your climate lessons? Choose two.” The first column in Table 3 shows what percentage of teachers overall voted for the different activities. The subsequent columns show preferences based on what grade level they teach, their self-described experience level in teaching about climate, and whether they are likely to use workshop materials to teach climate in cooperation with other subject matter teachers. The number in italics shows how many teachers are represented in that category.

Table 3: Percent of teachers favoring different activities from the workshop

<table>
<thead>
<tr>
<th>Activity</th>
<th>Most valuable activity from the workshop (percent of teachers favoring the activity)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall response</td>
</tr>
<tr>
<td></td>
<td>(20)</td>
</tr>
<tr>
<td>Lecture 1</td>
<td>41%</td>
</tr>
<tr>
<td>Lab 1</td>
<td>20</td>
</tr>
<tr>
<td>Lecture 2</td>
<td>3</td>
</tr>
<tr>
<td>Lab 2</td>
<td>33</td>
</tr>
<tr>
<td>Discussion</td>
<td>3</td>
</tr>
</tbody>
</table>

As shown in Table 3, the more fact-based Lecture 1 was rated most valuable to the teachers’ climate lessons with 41 percent of the votes. The more normative Lab 2 was in second place with 33 percent of the votes. While these rankings forced teachers to compare the activities to each other, all activities were rated highly on the evaluation, as mentioned above.

In comparing grade school and gymnasium teachers, the teachers of the younger students thought the Lab 2 would be most valuable in their classrooms. Teachers of different self-described experience levels were consistent with the overall group in considering Lecture 1 most valuable. For those teachers who planned to work across disciplines, both Lecture 1 and Lab 2 were nearly equally valuable.
Discussion

As described in the results, the workshop was appreciated and rated as very useful to the teachers who participated. Discussions in the focus groups provided further insight into how teachers might use the workshop information and materials in their classrooms, and for what purposes.

While recognizing the success of this workshop, an aim of this study is to identify opportunities to further develop climate education to address climate anxiety based on a review of relevant literature. In this section, the results from the study are therefore compared to the characteristics for ESD that are identified to be helpful in addressing climate anxiety, specifically using pluralistic teaching strategy, democratic working methods, and authentic issues. Next, limitations and suggestions for the study are discussed. Finally, conclusions and recommendations are offered.

Teaching strategies in the workshop

Of the three teaching strategies – fact-based, normative, and pluralistic – the pluralistic strategy was recommended in the literature to increase students’ action competence. However, the other strategies can offer other advantages. As described in the results’ analysis, the workshop and the focus group conversations contained mostly elements of fact-based and normative strategies. The pluralistic strategy of creating a dialogue between conflicting interests was not a strong focus of the workshop or the focus group dialogues. How these three strategies were incorporated in the workshop and discussed by teachers follows.

Fact-based strategy

The fact-based teaching strategy was emphasized in the workshop, especially in Lecture 1 and Lab 1. Lecture 1 explained climate change with a geological perspective. The teachers rated this the most valuable activity of the workshop with 41 percent of the votes. Theoretical discussion also occurred in explaining Lab 1.

Several teachers in the focus groups said that they appreciated the workshop’s balance between providing fact-based theory and practical activities. Some indicated it was important in their classroom to be able to explain the theory behind the labs to their students. Others said the theory was useful for the teachers’ own knowledge in case questions arise in the classroom, whereas the practical activities were useful to do with the students.

On the workshop evaluation, teachers offered suggestions for more scientific theory and activities. They wondered about, for example, how weather is affected by the climate, how climate change influences natural disasters, and how emission reductions affect prognoses for the future. One proposed a lab about uptake of carbon by plants.

Others wanted more information about what was being done at various societal levels – for example, politicians, international organizations, and businesses. Another was interested to know more about the last IPCC report, updates on the international climate negotiations and Sweden’s target.

Therefore, there was a clear focus in the workshop and demand from teachers for scientific theory and activities that emphasized the fact-based strategy. However, the literature on climate anxiety did not emphasize this strategy for increasing action competence.
Normative strategy

The normative strategy was also emphasized in the workshop and in the focus group discussions. As stated in the results’ analysis, Lecture 2 and Lab 2 aimed at changing behaviors and used primarily normative teaching strategies. Engström (2018), who observed the climate kit activities for her research, writes, “Knowledge content emerge during the session, but the normative intentions to influence behavior appear to be more important” (p.6).

The purpose stated for Lab 2 is to meet growing climate anxiety by giving students knowledge to reduce their carbon emissions. The organizers discuss doing this in a way that makes students feel empowered by their successes instead of guilty about not leading carbon neutral lives. This way to address climate anxiety seemed to be shared by several teachers who focused on the importance of students knowing good behaviors and then behaving in that way. Furthermore, on the workshop evaluation, teachers for grade 9 and younger rated Lab 2 the most valuable activity.

The normative strategy dominated comments from the teachers under the focus groups. Several mentioned the school’s environmental mission which is to give the students the opportunity to take responsibility for their own environmental impact (Skolverket, 2018, p.8). One teacher stated that it was not enough just to learn about what is good or bad, but that students apply that knowledge in their daily lives. Several teachers said that they had their students try out more environmentally-friendly behaviors, like not eating meat for a week. Sometimes this had lasting results, for example, some students became vegetarians. They saw Lab 2 as one that could provide substance to discussing environmentally-friendly behaviors, for example, by learning different foods’ CO2 emissions in the food activity.

The teachers discussed if what the students learn in the classroom about environmental behaviors follows with them in their adult lives. One teacher talked about a climate project for gymnasium students in the economy program. The teacher’s ambition is that when the economy program students go out in the working world and put on their economist clothes that they know that tackling environmental problems is part of their identity.

This indicates that the normative teaching strategy was emphasized in the workshop and focus group discussions. However, the literature on climate anxiety either did not emphasize or was even critical of the normative strategy (Kramming, 2017, p.202).

Pluralistic strategy

Despite pluralism being a recommended teaching strategy for ESD to increase action competence, it was not as emphasized in the workshop or by the focus group participants compared to the fact-based and normative strategies. A pluralistic strategy for Lab 2 could be to follow that activity with a discussion or debate about reducing carbon emissions related to, for example, electronic gadgets, local traffic or school lunches, and what different interests would be impacted by different proposals.

As another example, an activity offered at Stockholm’s Climate Festival, also organized by House of Science and Bolin Center for Climate Research, emphasizes the pluralistic approach. In the activity students are assigned to be “country representatives” and negotiate around carbon emissions reductions for their country as a simulation of the international climate negotiations. This activity was mentioned in Lecture 2 and at least one teacher said her students participated. Apart from that, the pluralistic strategy was not a main emphasis of this workshop or the focus group discussions.
Democratic working methods

The workshop was participatory in the sense that teachers got to participate in the activities and contribute to the discussions. The teachers did not have influence over the content of the workshop. However, the workshop maintained an optimistic tone about the ability of individuals to help the climate which is an important precondition for promoting action competence (Håkansson, 2010, p.102-103). Lab 2 was democratic in that it recognized diversity in the actions individuals can take to protect the climate. Overall, there was a medium emphasis on democratic methods in the workshop.

In discussing climate lessons, some teachers mentioned students having influence in the classroom. For example, the teachers discussed if they should assign environmentally friendly behaviors for students to try or whether the students should decide themselves.

Regarding democratic participation, some teachers’ ambitions were for their students to practice influencing at the school or political level. At the school level, this could be trying to reduce food waste or implementing a vegetarian day. At the political level, it could be writing a local politician about an issue. One teacher wanted to try an activity that supports students to take collective action, for example, in organizing a clothes swap. In these efforts, the focus shifts from normative, individual behaviors, to democratic participation in school and government policies.

Students can influence businesses as well, as was mentioned in Lecture 2, by what they choose to buy or not buy. Choosing to follow bloggers or influencers who are environmentally conscience is a way to influence the influencers and the businesses that sponsor them, according to teachers in the second focus group. Learning and practicing such ways to engage in society is helpful to counteracting climate anxiety.

Both the workshop and the teachers in the focus groups had a medium emphasis on democratic methods, whereas it is strongly emphasized in the literature to develop action competence.

Authenticity

In addition to pluralism and democratic working methods, another ESD characteristic of interest for this study was authenticity. Authentic education uses real-life situations as a base, allows for complexity and integrates across disciplines. How these characteristics were handled in the workshop and discussed by teachers are described below.

Realistic and complex

Climate change is a complex issue with real environmental, social, and economic interests and impacts. Natural disasters including wildfires, hurricanes, drought and flooding were covered extensively in the media in 2018. This coincides with dire warnings from the IPCC (2018) on one side and political backsliding from some countries on the other, making climate change a very current issue as well. This realism and complexity was lifted in the workshop’s lectures and lab activities and in the focus group dialogues. For example, Lecture 2 brought up some political, business and societal aspects of climate change action and responsibility. In Lab 2, the complexity around carbon emissions made it hard to determine the “right” answer and led to insightful discussions.

Realism and complexity were strong emphases in the workshop and focus group conversations as well as in the literature.
Multi-disciplinary teaching

Some teachers discussed working across subjects in their sustainable development or climate lessons. At one school, seventh grade classes have a six-week long block dedicated to a sustainable development project that included science, social studies, and Swedish. An outdoor education teacher said that her lessons often cover different subjects, for example, science, history, and Swedish, “because everything is related.” She thought it made more sense to teach in that way instead of dividing up the subjects into different pillars. Some schools had theme days that took up sustainable development, climate, social entrepreneurship, etc. For these days, subject teachers often worked together on the content of the day. The activities and lectures from the workshop could be used during these theme days, according to some of the teachers.

One question from the workshop evaluation asked “In what grade do you believe you will use the workshop materials together with other teachers in a multi-disciplinary way? (1=not at all, 5=very much).” Of the twenty teachers that filled out the survey, thirteen teachers expected to use the materials for interdisciplinary teaching (rating 4 or 5), while seven teachers were not as sure they would use them across multiple subjects (rating 2 or 3). While teachers overall thought Lecture 1 was most valuable for their climate lessons, those who expected to teach across subjects thought Lab 2 was almost equally valuable. (See Table 3)

While there is interest in interdisciplinary climate education from the teachers, the workshop was primarily scientifically based. The “Climate Kit” and workshop materials were primarily designed for a science classroom. While the workshop activities are linked to the Swedish curriculum for science subjects, geography and home economics, there could be opportunities to further support teachers who wish to teach about climate across subjects.

Socio-scientific issues

In SSI based instruction, real-life issues that are relevant to students are used as a basis for capturing student interest, learning scientific concepts, and investigating different perspectives on how that knowledge can be used to solve real-world issues, form values or make decisions (Presley, 2013). While SSI was not named explicitly, two of the projects mentioned in the focus group sessions seemed to fit a SSI profile. One was a cross-disciplinary project for 7th graders to build a house that could withstand natural disasters attributed to climate change. Another was a business-related climate project for gymnasium students in the economy program. Investigating technological and business solutions to reduce climate impacts enable students to explore links between climate science, technology innovations, social science, and business or economic models. Climate-related innovations (for example, see www.climatesolver.org) can be a source of inspiration to students. Using or developing SSI cases and projects is an opportunity for teachers and organizations that support teachers.

Summary

The teachers thought the workshop contained useful content for their own knowledge and to use in their classrooms. Given the analysis of the workshop observations and focus group discussions, different areas of emphasis in teaching methods emerged compared to what researchers recommend for increasing students’ action competence and constructively addressing climate anxiety. There was good agreement between the workshop, teachers and climate literature in emphasizing authentic issues, especially regarding realism and complexity. However, pluralistic teaching and democratic
working methods were emphasized more strongly in the literature than in the workshop or the focus groups. This is summarized in Table 4 which compares teaching strategies and characteristics of ESD to what was highlighted in the workshop, what the teachers discussed, and what the literature has recommended for increasing students action competence to counteract climate anxiety.

Table 4: Level of emphasis of climate education characteristics in the workshop activities, teacher focus group discussions, and literature on climate anxiety.

<table>
<thead>
<tr>
<th>Education characteristics</th>
<th>Workshop</th>
<th>Teachers</th>
<th>Literature on climate anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching strategies</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Fact-based</td>
<td>High emphasis</td>
<td>High emphasis</td>
<td>Low emphasis</td>
</tr>
<tr>
<td>- Normative</td>
<td>High emphasis</td>
<td>High emphasis</td>
<td>Low emphasis</td>
</tr>
<tr>
<td>- Pluralistic</td>
<td>Low emphasis</td>
<td>Low emphasis</td>
<td>High emphasis</td>
</tr>
<tr>
<td>Democratic working methods</td>
<td>Medium emphasis</td>
<td>Medium emphasis</td>
<td>High emphasis</td>
</tr>
<tr>
<td>Authentic issues</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Realistic/Complex</td>
<td>High emphasis</td>
<td>High emphasis</td>
<td>High emphasis</td>
</tr>
<tr>
<td>- Integrated/Interdisciplinary</td>
<td>Medium emphasis</td>
<td>High emphasis</td>
<td>High emphasis</td>
</tr>
</tbody>
</table>

Limitations and suggestions

Research on educational methods to address climate anxiety is a relatively new research field that needs to be constantly updated as more severe climate change impacts are experienced by an ever-expanding portion of the world’s population. Climate anxiety characterized by guilt may be replaced by fear of natural disasters or even coping with the result of natural disasters or forced relocation. Skills offered by pluralistic, democratic and authentic methods to critically think, communicate and act in a democratic society will likely remain important. However, perhaps new skills will also be demanded to address new climate realities, leading to new demands on education.

While developing and practicing action competence is important, pluralistic, democratic and SSI methods can be time-consuming. This creates a didactical tradeoff to provide the time required for self-directed research and other preparations for deliberative dialogues. Fact-based and normative methods require less time and have more predictable learning outcomes. Therefore, fact-based and normative methods may be better suited for a day-long teacher training, for example. It is also a limitation of this study to attend a workshop and talk to teachers about their reflections as opposed to seeing what actually happens in their classes. Therefore, the conclusions of this study should be taken as ideas to consider rather than a critique of the workshop or the teachers who participated. On the contrary, the workshop was very well-received, and the teachers were thoughtful and inspiring when discussing climate education.

Conclusion

While teachers expressed high satisfaction with the workshop in the focus groups and on the evaluation survey, it can also be useful to critically reflect on what the workshop offered and what the teachers discussed in comparison to different theories and strategies lifted by research on climate education and climate anxiety. The workshop and the focus group discussions emphasized fact-based and normative strategies over pluralistic teaching methods. While these strategies offer other benefits, some research suggests that pluralistic teaching methods can be more empowering to students (e.g.,
Caiman et al., 2018; Kronlid, 2010). Furthermore, when a problem can be viewed pluralistically from different perspectives, new solutions can arise.

Similarly, the literature emphasizes the importance of democratic working methods in helping students to engage, take action, and cope with instability (e.g., Lundegård, 2018; Ojala, 2007). While democratic working methods were not used directly in the workshop, there was a focus on increasing action competence, which is related to democratic participation. Conducting the workshop in a more pluralistic and democratic manner that promotes dialogue and gives the participants more voice could be an opportunity to further increase teachers’ experience in methods that can be implemented in their classrooms.

The workshop was authentic with regard to handling complex, real-life issues under different time perspectives -- characteristics recommended for ESD (e.g., Caiman et al., 2018; UNESCO, 2006). Given that the workshop emphasized the science curriculum, there could be an opportunity to strengthen cross-disciplinary aspects. Several teachers in the focus groups discussed multidisciplinary climate education, climate projects, and climate theme days. Thirteen of twenty teachers planned to use the course materials with other teachers from other subjects. That could represent an opportunity to design a workshop to further support teachers from different subjects that want to teach about climate using interdisciplinary methods.

Teaching with SSI relevant to climate change involves pluralistic, democratic, and authentic cross-disciplinary approaches. SSI-based instruction helps students develop not only scientific knowledge but other important skills such as critical thinking and problem solving (Ekborg et al., 2017; Presley et al., 2013). Promoting this approach aligns well with recommendations of characteristics for ESD by preparing students to address complex real-life issues now and in the future.

The competence and will to act empower students to mitigate and adapt to climate change. This is an important step toward a more sustainable world, which Greta Thunberg’s generation will carry forward.

Reference List


