

This is an electronic reprint of the original article. This reprint may differ from the original in pagination and typographic detail.

Primary school students' perceptions of a sustainable future in the context of a Storyline project.

Henriksson, Ann-Catherine

Published in:

LUMAT: International Journal on Math, Science and Technology Education

DOI:

[10.31129/LUMAT.11.1.1879](https://doi.org/10.31129/LUMAT.11.1.1879)

Published: 22/06/2023

Document Version

Final published version

Document License

CC BY

[Link to publication](#)

Please cite the original version:

Henriksson, A.-C. (2023). Primary school students' perceptions of a sustainable future in the context of a Storyline project. *LUMAT: International Journal on Math, Science and Technology Education*, 11(1), 69 - 90. Article <https://orcid.org/0000-0003-4701-4349>. <https://doi.org/10.31129/LUMAT.11.1.1879>

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Primary school students' perceptions of a sustainable future in the context of a Storyline project

Ann-Catherine Henriksson

Åbo Akademi University, Finland

All human decision-making is based on different expectations and assumptions about the future. Futures literacy, consisting of knowledge, emotions, and skills, is an essential competency for the 21st century. Educational steering documents, as the Finnish national curriculum, state that the teachers shall scaffold the students in problem solving, critical thinking and into a sustainable lifestyle now and in the future. The task is complex and challenging for the teachers. In this study a Storyline project was used as a frame for learning about sustainable living. The aim of the study was to study how students' perceptions of sustainable futures are visualized through the Storyline project and the meta-reflective dialogue. The research material consists of recorded group interviews with primary school students. The results of the thematic analysis show that different ecological skills, ecological concepts, and entities related to ecological sustainability, as well as cause-and-effect descriptions related to science, are present in the students' descriptions of the future. As emotional skills, students bring out empathy; empathy both for other people and for plants and animals. Students rely on their own competence to involve in sustainable development and as resources they highlight e.g. technological innovations, the importance of scientific knowledge, circular economy thinking as well as learning skills and social skills.

ARTICLE DETAILS

LUMAT Special Issue
Vol 11 No 1 (2023), 69–90

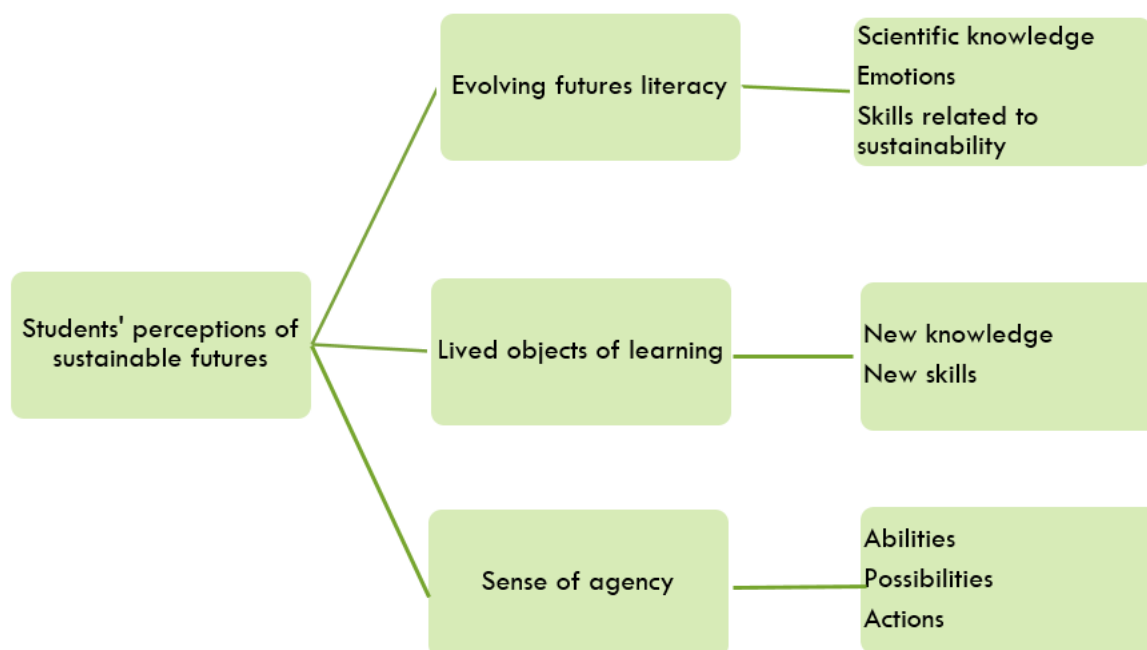
Received 28 October 2022
Accepted 29 May 2023
Published 22 June 2023

Pages: 22
References: 53

Correspondence: ann-catherine.henriksson@abo.fi

<https://doi.org/10.31129/LUMAT.11.1.1879>

Keywords: primary school, children's perceptions, sustainability, children's agency, futures literacy



1 Introduction

Today's children and young people are the decision makers of the future. In order to make good decisions now and in the future, young people need to master various key competences and have the knowledge required in various branches of science to distinguish between facts and opinions. Well-informed sustainable decisions and activities are needed, both at the individual and national level as well as at a global level. Currently we live in the Decade of Action (United Nations, 2020) to deliver the Sustainable Development Goals by 2030. The sustainable development goals reports (Sachs et al., 2022; United Nations, 2020) show that global efforts so far have been insufficient to deliver the change we need. This applies in particular to the goals concerning ecological sustainability.

The headlines in various mass media describing the difficult situation around e.g. climate change, littering of the oceans and decreasing biological diversity are also reaching today's young people. According to a large international report (Hickman et al., 2021) nearly 60% of young people (aged 16 – 25 years) approached said they felt very worried or extremely worried. The results are in line with the results from Neergaard and Ravnbøl (2019). Alongside the term climate anxiety, the term eco-anxiety is increasingly used (see eg. Pihkala, 2020). “The term [eco-anxiety] is used to describe various difficult emotions and mental states arising from environmental conditions and knowledge about them. Eco-Anxiety can result directly from an environmental problem, but most often it is an indirect impact.” (Pihkala, 2018, p. 546). In order to prevent climate anxiety or eco-anxiety, in parallel with knowledge and skills, the student also needs to experience a sense of hope for the future (Kelsey, 2016; Li & Monroe, 2019; Ojala, 2016; Pihkala, 2018). Empirical studies show the importance of focusing on solutions for developing hope (Li & Monroe, 2019).

This research study focuses on young students' thoughts about sustainability and, by extension, on activities and measures that teachers can use in their teaching about sustainability. However, Ojala (2021) reminds that young people cannot be perceived as a homogeneous group overall and this also applies to how young people relate to e.g. climate change.

The aim of the article is to study how students' perceptions of sustainable futures are visualized through the Storyline project and the meta-reflective dialogues. The three research questions to be answered are

1. What are the young students' perceptions of life in a fictional village in the future?
2. What are the students' perceptions of their lived objects of learning in the story-line project?
3. What are the students' perceptions of agency regarding preferable futures?

Finally, implications for future research about education for sustainability in early school years are elaborated. In the following chapters, the theoretical background around the concepts of futures literacy, agency and democratic participation is presented, as well as how these themes are visualized in various steering documents.

2 Futures in education and education for the future

All human decision-making is based on different expectations and assumptions about the future. Human efforts to know the future in the sense of thinking about the future are forms of anticipation. “[T]he future is incorporated into all phenomena, conscious or unconscious, physical or ideational, as anticipation” (Miller, 2018, p.77).

According to Rogers and Though (1996) people often underestimate the complexity of the learning process about potential futures. According to the report *Learning for the future* (UNECE, 2011) education for sustainable development includes knowledge but also beliefs and creative thinking:

“Exploring alternative futures leads to the identification of new pathways as an important step towards sustainable development. This process draws upon scientific evidence, uncovers current beliefs and assumptions that underlie our choices and encourages creative thinking about a wide range of possibilities. Involving learners in creating visions for the future will highlight ways in which actions taken today contribute to or detract from preferred futures. This offers ownership, creativity, direction and energy that can motivate people to make more sustainable choices in the present. Education for sustainable development (ESD) should emphasize approaches that are intended to lead to positive futures for people and nature, rather than those that simply do less harm.” (UNECE, 2011, p.17).

Despite the great interest in various future scenarios and the large amount of research about futures among young adults and secondary students (see e.g. Angheloiu et al., 2020; Cook, 2016; Rasa & Laherto, 2022), young children's views of possible and preferable futures have not been researched to the same extent. Hicks and Holden's (2007) results from two different surveys with the same target group (primary and secondary school students) constitute an exception here. According to Hicks and

Holden students in secondary school were more pessimistic about both local and global futures than the students in primary school. “The majority of the primary school students thought they could do something to bring about change. When asked what they did to make their local community or the world ‘a better place’, their responses fell into three broad categories: (i) environment; (ii) action and campaigns; (iii) relationships.” (Hicks & Holden, 2007, p. 506).

According to the UNESCO report (2020) futures literacy is an essential competence for the 21st century. Key competences are those which all individuals need for personal fulfilment and development, active citizenship, social inclusion and employment, and which constitute an integral part of an individual well-rounded competence-based education. Therefore, ‘competence’ is a broader concept than skill or competency and it encompasses knowledge, competencies, skills, abilities, capacities, attitudes, values, attributes and qualities necessary for lifelong learning (European Commission, 2017; Halász & Michel, 2011). Futures literacy, the capability to ‘use-the-future’ for different reasons and in a variety of ways (Miller, 2018) requires the ability to identify future assumptions that guide our own thinking and actions. Futures literacy consists of three areas: knowledge (cognitive capacity), emotions (emotional capacity) and skills (competence to act) (Pouru & Wilenius, 2018).

GreenComp is a reference framework for sustainability competences (European Commission, 2022). The framework is created in order to provide a common ground to learners and guidance to educators, advancing a consensual definition of what sustainability as a competence entails. GreenComp consists of 12 competences organized into the four areas *Embodying sustainability values*, *Embracing complexity in sustainability*, *Envisioning sustainable futures* and *Acting for sustainability* (See Figure 1). The area Envisioning sustainable futures includes the competences *Futures literacy*, *Adaptability* and *Exploratory thinking*. Futures literacy is described as follows “[T]o envision alternative sustainable futures by imagining and developing alternative scenarios and identifying the steps needed to achieve a preferred sustainable future.” (European Commission, 2022, p. 23).

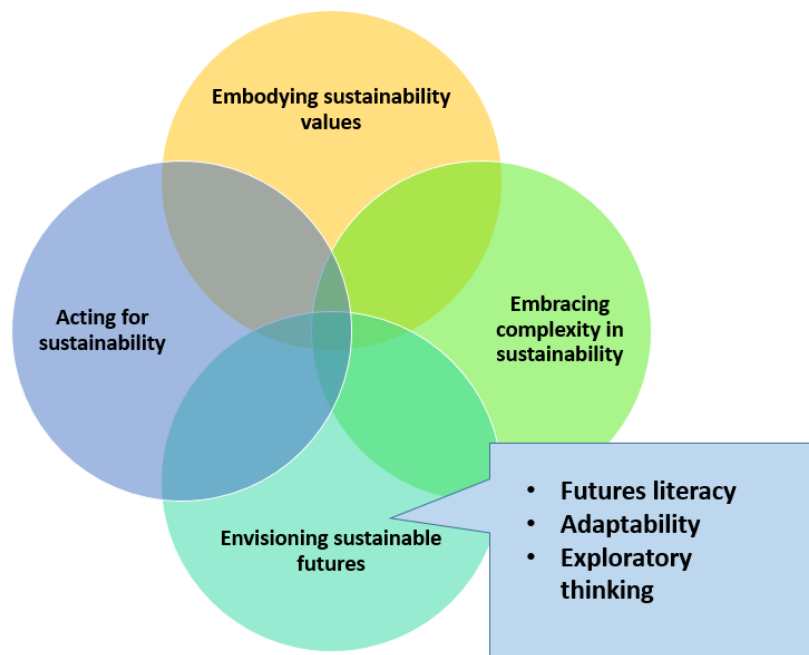


Figure 1. GreenComp, the European sustainability competence framework (European Commission, 2022) comprises four interrelated competence areas

ESD is both subject specific and thematic and ESD includes both the what, why and how aspects of didactic (Gericke et al., 2020). ESD is a key element of quality education. Its cross-cutting competencies in cognitive, socio-emotional and behavioural dimensions of learning bear relevance to all areas of education. (UNESCO, 2020). Sund, Gericke and Bladh (2020) as well as Wals (2011) encourages teachers to use cross-curricular teaching in ESD in order to combine knowledge rooted in subject specific discipline and complex authentic problems, that might affect the student in their own life world. Both Ojala (2016) and Hicks and Holden (2007) suggests that teachers can use key concepts from futures studies, such as probable, preferable and possible futures to help students develop a futures perspective.

Learning about sustainability includes knowledge and different kinds of skills but also attitudes and values. According to Illeris (2003, 2009) there are two basic processes and three dimensions of learning (see Figure 2). The two processes are one external interaction process between the learner and the social, cultural or material environment, and one internal psychological process of adaption and acquisition. Both processes must be actively engaged if any learning is to take place. The processes move between three aspects, namely content, incentive and environment. Content regards what is learned, such as knowledge, skills, opinions, attitudes, values and behavior. It helps building apprehension. Incentive relates to the mental drive, necessary for learning processes to take place. It involves emotions, motivation and

intentions. Environment relates to the external material world. The dimensions of content and incentive emerges from impulses from the interaction process and are involved with the internal process of acquisition. Learning content is connected to the present incentives, i.e., interest, motivation, desire or obligations. As a consequence, incentives are influenced by the content.

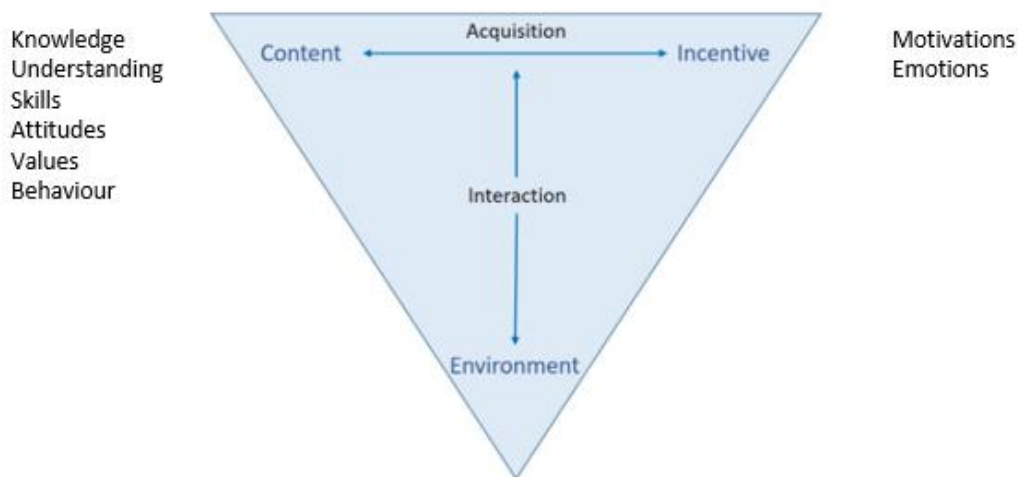


Figure 2. The two learning processes and three learning dimensions (modified from (Illeris, 2003))

In the learning process the planned content, or the intended object of learning, is not necessarily identical to the learning that the student ultimately demonstrates and experiences as learning. Marton and Pang (2006) describe the different forms of content as *intended object of learning*, i.e. the content described in the curriculum, *enacted object of learning*, i.e. how the teaching around the content is carried out and *lived object of learning*, i.e. the student's perception of learning.

Just as important as examining education in the future or the future of education is examining how different possible futures are interrogated *in* education (Hicks & Holden, 2007). Nordic Council of Ministers (Jónsson et al., 2021) presented a report concerning the implementation of UN Sustainable Development Goal 4.7 (*Ensure that all learners acquire the knowledge and skills needed to promote sustainable development*) in compulsory education in Denmark, Finland, Iceland, Norway, and Sweden. The aim with the report was to receive an overview of how well each of the Nordic countries had integrated the UNSDGs into their educational policies and practices. According to the results in the report even within the countries where sustainability is an explicit concern there are causes for concern. A recommendation from the authors of the report is that national educational paradigms in the countries shift from

education for sustainable development towards *sustainable education* in line with Stephen Sterling's model where knowledge acquisition should not be separated from work focusing on intentions and emotions, but rather integral to both of them. Likewise, emotions should be grounded in both knowledge and a sense of action competence. (see Sterling, 2014). Educational steering documents as the Finnish national curriculum (FNBE, 2016) state that the teachers shall scaffold the students in problem solving, critical thinking and into a sustainable lifestyle now and in the future. According to Mykrä (2021) the everyday life of primary school contains a large number of dilemmas for promoting ecological sustainability. Focusing on one element of the action, such as the tools to promote ecological sustainability, is not enough, but all the elements of the action and the interactions between them are important.

Being able to face sustainability issues in teaching in order to also act as future citizens is a democratic right for the student (Lundegård & Caiman, 2019). The strength of connecting natural science subjects to social issues and vice versa was already presented by the philosopher John Dewey (2000). In Sweden a systematic research analysis was made on the use of socio-scientific issues (SSI) in the classrooms (Skolforskningsinstitutet, 2022). The importance of developing students' conditions for democratic participation and action skills was highlighted in many of the studies in the analysis. According to the results however, these goals did not appear to the same extent in a clear way for the students who participated in the teaching being studied.

According to the social constructivist view of learning, learning is situated in time and space, learning is social and the student is active in his own learning. Student's agency is understood as a dialogic process which develops in interactions between individuals and the environment. (Vygotsky, 1978). "When students are agents in their learning, they are more likely to have "learned how to learn" – an invaluable skill that they can use throughout their lives" (OECD, 2019, p. 2). The student's self-image in combination with the self-esteem and belief in his own abilities affects the kind of goals the student sets for himself (FNBE, 2016).

When learning about sustainable issues and different alternative futures the steps before the student feel a sense of agency and empowerment can be both cognitively and emotionally hard. Rogers and Tough (1996) identified five stages of learning when they observed students learning about possible futures. The five stages or dimensions are: cognitive dimension, affective dimension, existential dimension, empowerment dimension and action dimension. According to Rogers and Tough the

affective dimension can include a broad specter of emotions, from hopelessness to hopefulness. Collaborative learning and sharing of concerns can, according to the authors, help students in the process.

According to the Finnish curriculum, the student must have opportunities to reflect on conflicts between consumption and production methods that are at odds with a sustainable future. In addition, one must together try to find and apply solutions that correct an unsustainable lifestyle. The basic education must open perspectives towards a global responsibility that spans generations. (FNBE, 2016). Opting out of these issues is therefore not an option. Lundegård and Caiman (2019) highlight five forms of participation that teaching needs to offer students; I) deliberative conversations, II) take the initiative and pursue urgent issues, III) create new solutions to problems, IV) reflect critically and V) stay in areas that are authentic for the student. According to the authors, deliberative conversations are "the meaning-making that takes place when students interact communicatively with each other in order to find out and solve problems." (Lundegård & Caiman, 2019, p. 43). Engaging in deliberative discussions has also according to a systematic review of the research in the field (Monroe et al., 2019) shown to contribute to effective teaching about climate change in formal and non-formal settings.

3 Storyline as an approach for learning about sustainable development

Without a vision of utopia there is no way to define that port to which we might want to sail (Harvey, 2000). In order to develop skills and attitudes necessary for active citizenship and sustainable development different kinds of active and participative learning approaches have been used by teachers. Several of these approaches includes active use of imagination and educational drama. The ability to imagine and anticipation are two intertwined capabilities (Miller, 2018). According to Häggström and Schmidt (2021, p. 3) imagination, or fantasy, "is one of the driving forces needed to develop futures literacy." "Working in role, both teacher and pupils are actively recreating and adapting their perceptions of the world and the people in it. Out of role, reflection and analysis of the drama helps to extend and deepen understanding of how human beings respond and react to experiences and situations." (McNaughton, 2006, p. 21). By educational drama different sustainability issues are explored in a more holistic multi-faceted way (McNaughton, 2006, 2010). Art-based learning, including drama, offers opportunities for the student to involve different emotions and use

critical thinking and creativity (Caiman & Lundegård, 2018; Lehtonen et al., 2019, 2020).

The Storyline approach (TSA) was created in the 1960-ies in Glasgow by the Staff Tutor Team of the Jordanhill College of Education, now the Faculty of Education of the University of Strathclyde. Storyline is a teaching approach where fictive frames and characters are used to create an authentic learning context (Harkness, 2007). Theoretically TSA is based on educational philosophers as John Dewey and Jeromy Bruner. (Harkness, 2007). “Storyline is an integrated approach that draws subjects together creating links across the curriculum. ...Pupils are invited to create a setting, invent characters and explore incidents (plot). The logical sequence of ideas, presented in the form of descriptive narrative, provides a structure for exploring many diverse themes or topics.” (Harkness, 2007, p. 20). The narrative approach allows students to encounter and process real life incidents and problems in a safe surrounding. TSA is therefore also used by teachers with students at different age and with teacher students for teaching and learning about different sustainable development issues. Teachers using TSA report that the sense of agency young people experience through active engagement in real world issues has a meaningful impact on their self-esteem and wellbeing. (Høeg Karlsen, 2020).

TSA is interactive, holistic, cross-curricular and focuses on problem-solving skills and individual and collective agency. The use of active and engaging teaching methods are common to most environmental education (Monroe et al., 2019). This is also completely in accordance with UNESCO’s criteria (UNESCO, 2020) for Education for Sustainable Development (ESD). In parallel with subject knowledge within various scientific disciplines, the student needs to practice various central competencies such as learning to learn. According to the Finnish curriculum (FNBE, 2016, p. 20) ” The students must be encouraged to look at things from different perspectives, seek new information and, based on it, reflect on their way of thinking. ... In order to find innovative solutions, it is assumed that students learn to open-mindedly see alternatives and combine different perspectives and use their imagination to transcend existing boundaries”.

4 Methodology and approach

The qualitative study was conducted with primary school students ($N = 31$) in grade two in two parallel school classes. The students were about eight years old. In the effort to work towards the objectives that concern learning for sustainable development in the curriculum (intended object of learning), the students worked for about seven weeks with the theme area "The village of the future" (enacted object of learning) (see Marton & Pang, 2006). The cross-curricular work was implemented as a Storyline project. During the seven weeks, students created personal fictional characters. The students created a village where these characters could live and work. In working with the village, the students had to, by their character, take a stand on and make decisions about various issues such as food production, energy supply, education, leisure activities and communications. The students also worked with fictitious social problem situations that can arise in the village. The various stages of the work were realized in response to what in storyline pedagogy are referred to as key questions (see e.g. Harkness, 2007). The writer of this article visited the school once while the students were working with the project. During the work in the groups, the students used different multi-literary forms of work. With the tools of the visual arts, the students created buildings and landscapes and with the help of digital tools they created e.g. films. The artefacts that the students produced in the Storyline process was not used as research material.

The study's empirical material was collected through seven group interviews (4 – 5 students in each group) with the students shortly after the students had completed the work on the theme unit. Due to the pandemic situation the interviews were conducted remotely via the Zoom tool. The interview sessions with open questions had the character of meta-reflective dialogues (Pramling Samuelsson & Asplund Carlsson, 2014). The conversations provided an opportunity for reflection and meta-communication in the groups. The participating students often filled in their answers in a sentence that another student had started. The children's own way of thinking was challenged by hearing other children's thoughts about the same thing and the children could take part in a variety of thoughts and opinions (see Marton & Pang, 2006). Some of the students did not participate so actively in the discussion, but were still able to listen to other students' thoughts in order to reflect their thoughts and opinions towards them.

In a meta-reflective dialogue, the conversation can move on three levels (Pramling Samuelsson & Asplund Carlsson, 2014); I) on a direct level around the concrete and

visible, II) on a structural level around wholes and contexts or on III) a reflective level around the learning and implications of the learning. The students were invited and encouraged to discuss and talk about the work with the theme 'The future village', about what they had possibly learned through the work and about their thoughts about the future more generally. The seven taped and transcribed group conversations (about 30 minutes each) constitute the study's empirical material.

The empirical material was analyzed based on the study's research questions through thematic analysis. “[t]hematic analysis involves the searching across a data set ... to find repeated patterns of meaning.” (Braun & Clarke, 2006, p. 11). The data corpus of students’ experiences was analysed thematically on three levels: 1) a data set comprising all instances in which the students referred to the research questions; 2) data extracts that were analysed and thematically coded; and 3) qualitatively different themes on a general level that were coded. Quotes are used to illustrate these themes’ meaning.

This study followed the ethical standards set out by the Finnish National Board on Research Integrity. All students who participated in the group interviews, as well as their guardians and teachers, gave their permission to participate in the study. Written research permits have also been granted by the municipality officers. To protect the integrity of the participating students, their thoughts are quoted completely anonymously. The children, the teachers and the parents could end their voluntary participation in the study at any time.

5 Results

In the following, the results from the analysis are presented in accordance with the three research questions. For each question the qualitatively different themes are presented. These are specified through thematically coded extracts and exemplified with direct quotes (in italics).

5.1 Students’ perceptions of life in future

The students were asked to describe the life of their characters in their fictive village. The qualitatively themes that rose from the discussions are described in [table 1](#).

Table 1. Students' perceptions of life in future

Qualitatively different themes	Thematically coded extracts
Skills related to sustainability	Moving by bike Passing on clothes Using flea markets Reduction of litter
Evolving scientific understanding	The important role of trees Benefits with eating vegetarian food Solar power and other renewable energy sources Scientifically incorrect concepts and descriptions
Innovations and technological inventions	Innovative machines Innovative electricity producing
Empathy for plants and animals	Not cutting living trees and plants Animals can be stuck or die because of people's littering
Social and physical wellbeing	Having a family Knowing how to say things to others Being physically healthy A safe place to live

In the village the characters move by bike instead of driving by car. When the clothes they wear become too small you pass on the clothes to others. New clothes and other things can be bought from a flea market. Reduction of litter is important and the characters use glasses and plates at parties instead of disposable tableware. The characters are also saving paper.

The students talk a lot about the important role of trees and, without naming the concept photosynthesis, the process can be found in the students' discussions. The characters in the village are eating mostly vegetarian food and the students compare vegetarian food with eating meat food. *"Green food is better .. you can grow it from seeds and it becomes a salad and so on. Well, it's environmentally friendly."* The benefits of locally produced food are also discussed. There is a lot of discussion around the comparison of oily fuels to solar power and other renewable energy sources. *"When you build electric cars, a lot of gas is released into the air. A solar powered car would be better. But if it's rainy days ... that you only use electric cars on sunny days ... or you can collect the sun ... if it's sunny days and you're not driving outside, the car would still collect electricity."*

Some scientifically incorrect concepts and descriptions can be found in the students' discussions. This is especially frequent when students are talking about physical phenomenon as e.g. ” *[S]uch an electric machine with a lamp to operate it “ and “A machine with a permanent battery”*.

According to the students there are a lot of innovative machines in the village. There is a food machine, a water machine, a garbage sorting machine and a robot that washes dishes. You can get electricity from a bicycle that produces electricity and from the wind farm.

Different aspects of empathy can be heard in the students' discussions. The students show empathy for plants and animals. “*Nature should feel good.*” According to the students you should not cut down or damage living trees. Littering can also be harmful for animals. “*Yes, remember that you shouldn't litter because then the animals can get stuck in it and then they die. You shouldn't throw chewing gum in nature because then crows or birds can get it in their beaks so they can't touch it.*”

The social and physical wellbeing of the characters is important according to the students. “*That you would have a family. That you have a good life. That you don't have to be sick.*” “*It must also be a safe place to live. There are no naughty people there.*” “*That you know how to say things to others. If you say the wrong things, you know what to do. That you are not making the wrong decision. You have to think about it.*”

5.2 Students' perceptions of lived objects of learning

Here the focus is on the students' perceptions of lived objects of learning, the student's perception of what they have learned during the work with the village. (see Marton & Pang, 2006). The students were asked to think on things they did not know before but know now after the work with the Storyline topic. Likewise, they were asked to think about new skills or things they can do now. This proved to be a challenging task for the students. This applies to all groups. In this reflection, it is specifically about the students' perceptions of their own learning, not about everything that they have probably also learned. The themes that the students arrive at after reflection and discussion are the following (see Table 2).

Table 2. Students' perceptions of lived objects of learning

Qualitatively different themes	Thematically coded extracts
Physical wellbeing	Good hygiene The importance of exercise
Social wellbeing	Social relations Making decisions together
Subject knowledge	Learning about nature Learning about maps
Skills and activities to protect the environment	Save on fuel Sorting of litter Reusing
General practical skills	Making videos Designing the houses To use the scissors To glue

In their discussions, the students were telling about subject knowledge as well as about different skills related to sustainability. During the work with the village, the teacher had told the students about life in the locality long ago. The students were fascinated about this story and in all groups; students could reproduce how people used to take care of their hygiene and how schooling took place in the past. Concrete issues and skills can be found in all students' stories. This is accentuated when the students talk about what they have experienced as difficult. *"I thought that house was a bit tricky when you have to think carefully about what to have inside and how it should look."* *"It was a little difficult to cut fabric when the fabric didn't want to tear."*

5.3 Students' perceptions of agency

Based on social cognitive theory Alfred Bandura, when analyzing and defining human agency, highlights the importance of people's beliefs about their capabilities. "Self-efficacy beliefs function as an important set of proximal determinants of human motivation, affect, and action." (Bandura, 1989, p. 1175) The themes where the students are talking of their perceptions of hope, possibilities and self-efficacy according to different sustainability issues are visualized in [table 3](#).

Table 3. Students' perceptions of agency

Qualitatively different themes	Thematically coded extracts
To use nature's possibilities	How to get water from the nature How to get food from nature You can stay overnight in nature You can live in space
Technology and innovation as possibilities	You can use solar power and wind power Innovative car models Building innovations The use of robots
Circular economy	Buying second-hand goods Exchanging goods online Repairing items that are broken
Social skills	Instruct and help others Knowing how to apologize Resolve and mediate dilemmas
Prevention of dangerous and frightening situations	Prevention of illness Prevention of fire Prevention of fighting situations
Increasing learning and skills as possibilities	School education as a possibility Increased scientific knowledge Good cooking skills

The students are describing different abilities, possibilities, and actions. According to the students', nature can provide us with water and food. The students are describing how you can get water from the nature. and they are also explaining on different possibilities how to get food from nature or grow your own food. *"A lot of people don't know this, but you can actually eat the inside of the bark of a tree. If you cut off the shell. You cannot eat on the outside, but inside, right there and right on top of the shell, you can eat. I've been watching a program where they eat."* According to the students you can stay overnight in nature and in future, you can even live in space.

The students describe how they in the future can use solar power and wind power. They also describe how the cars may look in the future and different building innovations overall. Robots are also experienced by students as something that they will use to a greater degree than now.

The students describe how they can reduce their consumption in different ways. They can buy second-hand goods at flea markets; they can exchange goods online via different webpages and repair items that are broken.

The students feel that they have mastered social skills that will be important in the future as well. They can instruct and help others and know how to apologize when needed. They also feel that they know how to resolve and mediate dilemmas. *“You should be kind ... you should say nice things.” That you try to say sorry straight away. Trying to figure it out.”*

The students look upon their school education as an opportunity to learn how to manage in the future and to prevent poverty. *“That all children should learn.”* Increased scientific knowledge is especially important. Mathematical knowledge and knowledge in mother tongue are also important according to the students *“so that you don't get cheated when you're an adult”*. Good cooking skills are important to have in the future.

6 Discussion

According to the Finnish curriculum students must learn to understand the significance of their choices, lifestyle and actions, not only for their own life, but also for the immediate surroundings, society and nature (FNBE, 2016). In teaching that touches on themes such as climate change Monroe (2019) as well as Wals (2011) recommend the teacher to strive to do the content personally relevant and meaningful for learners and to design activities that engage the students. In this study, the teacher, in connection with the goals and content of the curriculum, chose to use the Storyline approach where the student acts and solves problems via his own character. Everything happens in a fictional future. In the meta-reflective discussions in the interview situation, the students do not act in role but as themselves when they reflect on their thoughts and their work around The future village. When the students were asked to describe the life in the fictional village the discussion moves both on a direct level around the concrete and visible and on a structural level around wholes and contexts (see Pramling Samuelsson & Asplund Carlsson, 2014).

When the students are talking about the life in the future village all three areas of futures literacy can be found; knowledge (cognitive capacity), emotions (emotional capacity) and skills (competence to act) (see Pouru & Wilenius, 2018). According to the GreenComp-report (European Commission, 2022) futures literacy encourages

learners to use imagination, intuition and creativity to assess possible steps needed to achieve the preferred future.

In the students' discussions, signs of evolving scientific understanding can be seen. The students are young and consequently scientific misconceptions are also found in the discussions. Teachers who continuously before and during work give the students space to communicate their knowledge can, with adaptation to the students' age level, grasp the misconceptions and guide the students out of them.

Just as interesting as investigating what the students are talking about is listening to what the students are not talking about. Climate change as a concept does not appear in these students' descriptions. Nor can signs of climate anxiety be directly noticed in the student group discussions. These findings are in line with the results from Hicks and Holden (2007) about climate anxiety among primary school students. A follow-up study after a few years with the students in the current study could show whether and, if so, how these students' perceptions of the future still hold.

To put words on lived objects of learning, i.e. the student's perception of learning (Marton & Pang, 2006) during the work with the village, proved to be challenging for the students. Concepts such as learning and knowing can be very abstract for these young students. The students' conversations moved mainly on the level of the concrete and visible and to a lesser extent on the reflective level of learning.

In order to prevent climate anxiety, in parallel with knowledge and skills, the student needs to experience a sense of hope for the future (Kelsey, 2016; Li & Monroe, 2019; Ojala, 2016; Pihkala, 2018). Empirical studies show the importance of focusing on solutions for developing hope (Li & Monroe, 2019). In this study, signs of students' perceptions of agency were looked for. Agency is here defined as a sense of responsibility, competence and a willingness to work for a better future (see OECD, 2019). During the work with the cross-curricular Storyline topic The future village the students lived into other people's way of thinking, too look upon issues from different perspectives and students were challenged to solve problems together.

As results from the analysis a positive picture of these students' perceptions of agency can be seen. Whether the positive image already existed among the students before the work with the Storyline topic or whether it has arisen or developed during the work does not appear in the study. The students rely on their own abilities and competences. At the same time, they also show that they see the importance of continued education both when it concerns increased knowledge and e.g. scientific knowledge, and new skills such as cooking skills.

Engaging in deliberative discussions has shown to contribute to effective teaching about climate change (Lundegård & Caiman, 2019; Monroe et al., 2019). In this work with the Storyline topic the students had the opportunity to reflect on conflicts between consumption and production methods that are at odds with a sustainable future and together try to find and apply solutions that correct an unsustainable lifestyle (see (FNBE, 2016).

7 Implications

Learning about sustainability is about learning new knowledge, competences, skills but also about communicating different values and attitudes. (European Commission, 2017, 2022; Halász & Michel, 2011; UNESCO, 2020). Children need repeated opportunities for meta-reflective dialogues (Pramling Samuelsson & Asplund Carlsson, 2014) where children have the opportunity to communicate their thoughts and listen to other students' thoughts. Communicating values and attitudes is challenging, especially when it comes to young students. According to Pepper (2011) the assessment of attitudes that support the development of knowledge and skills is still not widely developed in the EU. In addition, the three components (knowledge, skills and attitudes) need to be assessed in interaction rather than in isolation. Teachers in the schools have “a key role to play for developing young people’s attitudes, character traits and dispositions that will support them in confronting emerging societal challenges, such as resilience, adaptability, entrepreneurship, or sensitivity to cultural and personal differences.” (Hill & Barber, 2014, p. 16). In accordance with Illeris' model of learning (Illeris, 2003), this presupposes that the student has the opportunity to participate in situations where attitudes and values are discussed in a context that the student experiences as engaging and motivating.

The need for common understanding of key competences and relevant assessment practices to assess student learning are highlighted in the European Commission report (European Commission, 2017). Teacher education and teachers' in-service education are seen as contexts in which this training of the teachers could take place. In the report from OECD (2019) teachers need further education in designing learning environments that support student agency. Pihkala (2020) also calls for increased training for teachers “to practice self-reflection about their emotions and attitudes, ideas for development of organizational practices, and the effort to provide various positive role models of coping with eco-anxiety”.

In research on teacher training and continuing education, attention has already been paid to these challenges (see e.g. Aksela & Tolppanen, 2022), but continued research in the area is needed.

In this study, the teacher used the Storyline approach as a tool for learning. Most of the research concerning the use of Storyline in teaching has focused on teachers' perceptions of the approach and only a small part of the research has focused on the student's perspective. The voices of young students in particular have been highlighted to a very low degree and more research is needed. The story and the characters in the study enabled the events to be placed in a fictional context, which, based on the conversations in the interviews, was experienced by the students as motivating. The three central parts of Illeris' model of learning (Illeris, 2003) were present; motivation, content and environment. Lundegård and Cainman (2019) emphasize the importance of students staying in authentic learning environments. Since the future cannot be an authentic learning environment, here the fictitious learning environment can function in its place in the work for increased futures literacy for the students.

Acknowledgements

The research was conducted within an international Erasmus project, and it is funded by Erasmus+.

References

- Aksela, M., & Tolppanen, S. (2022). Towards Student-Centered Climate Change Education Through Co-design Approach in Science Teacher Education. In Y.-S. Hsu, R. Tytler, & P. J. White (Eds.), *Innovative Approaches to Socioscientific Issues and Sustainability Education* (pp. 85–99). Springer Nature Singapore. https://doi.org/10.1007/978-981-19-1840-7_6
- Angheloiu, C., Sheldrick, L., & Tennant, M. (2020). Future tense: Exploring dissonance in young people's images of the future through design futures methods. *Futures*, 117, 102527. <https://doi.org/10.1016/j.futures.2020.102527>
- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, 44(9), 1175–1184. <https://doi.org/10.1037/0003-066X.44.9.1175>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. <https://doi.org/10.1191/1478088706qp0630a>
- Caiman, C., & Lundegård, I. (2018). Young children's imagination in science education and education for sustainability. *Cultural Studies of Science Education*, 13(3), 687–705. <https://doi.org/10.1007/s11422-017-9811-7>
- Cook, J. (2016). Young adults' hopes for the long-term future: From re-enchantment with technology to faith in humanity. *Journal of Youth Studies*, 19(4), 517–532. <https://doi.org/10.1080/13676261.2015.1083959>
- Dewey, John. (2000). *Experience and nature*. Dover.

- European Commission. (2017). *Assessment practices for 21st century learning: Review of evidence : analytical report*. Publications Office. <https://data.europa.eu/doi/10.2766/71491>
- European Commission. (2022). *GreenComp, the European sustainability competence framework*. Publications Office. <https://data.europa.eu/doi/10.2760/13286>
- FNBE. (2016). *National Core Curriculum for Basic Education 2014*. Finnish National Board of Education.
- Gericke, N., Huang, L., Knippels, M.-C., Christodoulou, A., Van Dam, F., & Gasparovic, S. (2020). Environmental Citizenship in Secondary Formal Education: The Importance of Curriculum and Subject Teachers. In A. Ch. Hadjichambis, P. Reis, D. Paraskeva-Hadjichambi, J. Činčera, J. Boeve-de Pauw, N. Gericke, & M.-C. Knippels (Eds.), *Conceptualizing Environmental Citizenship for 21st Century Education* (Vol. 4, pp. 193–212). Springer International Publishing. https://doi.org/10.1007/978-3-030-20249-1_13
- Häggström, M., & Schmidt, C. (2021). Futures literacy – To belong, participate and act! *Futures*, 132, 102813. <https://doi.org/10.1016/j.futures.2021.102813>
- Halász, G., & Michel, A. (2011). Key Competences in Europe: Interpretation, policy formulation and implementation: European Journal of Education, Part I. *European Journal of Education*, 46(3), 289–306. <https://doi.org/10.1111/j.1465-3435.2011.01491.x>
- Harkness, S. (2007). Storyline – An Approach to Effective Teaching and Learning. In *Storyline. Past, Present & Future*. University of Strathclyde.
- Harvey, D. (2000). *Spaces of hope*. Edinburgh University Press.
- Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, E. R., Mayall, E. E., Wray, B., Mellor, C., & van Susteren, L. (2021). Young People’s Voices on Climate Anxiety, Government Betrayal and Moral Injury: A Global Phenomenon. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.3918955>
- Hicks, D., & Holden, C. (2007). Remembering the future: What do children think? *Environmental Education Research*, 13(4), 501–512. <https://doi.org/10.1080/13504620701581596>
- Hill, P., & Barber, M. (2014). *Preparing for a Renaissance in Assessment*. Pearson.
- Høeg Karlsen, K. (Ed.). (2020). *Teaching through Stories. Renewing the Scottish Storyline Approach in Teacher Education*. Waxmann Verlag GmbH. <https://doi.org/10.31244/9783830989868>
- Illeris, K. (2003). Towards a contemporary and comprehensive theory of learning. *International Journal of Lifelong Education*, 22(4), 396–406. <https://doi.org/10.1080/02601370304837>
- Illeris, K. (2009). *Lärande* (2. edition). Studentlitteratur.
- Jónsson, Ó. P., Guðmundsson, B., Øyehaug, A. B., Didham, R. J., Wolff, L.-A., Bengtsson, S., Lysgaard, J. A., Gunnarsdóttir, B. S., Árnadóttir, S. M., Rømoen, J., Sund, M., Cockerell, E., Plummer, P., & Brückner, M. (2021). *Mapping Education for Sustainability in the Nordic Countries*. Nordic Council of Ministers. <https://doi.org/10.6027/temanord2021-511>
- Kelsey, E. (2016). Propagating Collective Hope in the Midst of Environmental Doom and Gloom. *Canadian Journal of Environmental Education*, 2.
- Lehtonen, A., Österlind, E., & Viirret, T. L. (2020). *Drama in Education for Sustainability: Becoming Connected through Embodiment*. <https://doi.org/10.26209/IJEA21N19>
- Lehtonen, A., Salonen, A. O., & Cantell, H. (2019). Climate Change Education: A New Approach for a World of Wicked Problems. In J. W. Cook (Ed.), *Sustainability, Human Well-Being, and the Future of Education* (pp. 339–374). Springer International Publishing. https://doi.org/10.1007/978-3-319-78580-6_11
- Li, C. J., & Monroe, M. C. (2019). Exploring the essential psychological factors in fostering hope concerning climate change. *Environmental Education Research*, 25(6), 936–954. <https://doi.org/10.1080/13504622.2017.1367916>

- Lundegård, I., & Caiman, C. (2019). Didaktik för naturvetenskap och hållbar utveckling—Fem former av demokratiskt deltagande Education for science and Sustainable Development—Four forms of Democratic Participation. *Nordic Studies in Science Education*, 15(1), 38–53. <https://doi.org/10.5617/nordina.4822>
- Marton, F., & Pang, M. F. (2006). On Some Necessary Conditions of Learning. *Journal of the Learning Sciences*, 15(2), 193–220. https://doi.org/10.1207/s15327809jls1502_2
- McNaughton, M. J. (2006). Learning from participants' responses in educational drama in the teaching of Education for Sustainable Development. *Research in Drama Education: The Journal of Applied Theatre and Performance*, 11(1), 19–41. <https://doi.org/10.1080/13569780500437572>
- McNaughton, M. J. (2010). Educational drama in education for sustainable development: Ecopedagogy in action. *Pedagogy, Culture & Society*, 18(3), 289–308. <https://doi.org/10.1080/14681366.2010.505460>
- Miller, R. (Ed.). (2018). *Transforming the future: Anticipation in the 21st century*. Routledge.
- Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: A systematic review of the research. *Environmental Education Research*, 25(6), 791–812. <https://doi.org/10.1080/13504622.2017.1360842>
- Mykrä, N. (2021). *Peruskoulu ekologista kestävyttä edistämässä. Toiminnanteoreettinen tutkimus koulun monitasoisesta muutoshasteesta* [Doctoral thesis, University of Tampere]. <https://urn.fi/URN:ISBN:978-952-03-1878-9>
- Neergaard, I. M., & Ravnbøl, K. (2019). *Nordic Youth As Sustainable Changemakers*. Nordic Council of Ministers. <https://doi.org/10.6027/NO2019-027>
- OECD. (2019). *Student agency for 2030. OECD Future of Education and Skills 2030. Conceptual learning framework*. https://www.oecd.org/education/2030-project/teaching-and-learning/learning/student-agency/Student_Agency_for_2030_concept_note.pdf
- Ojala, M. (2016). Facing anxiety in climate change education: From therapeutic practice to hopeful transgressive learning. *Canadian Journal of Environmental Education*, 21.
- Ojala, M. (2021). To trust or not to trust? Young people's trust in climate change science and implications for climate change engagement. *Children's Geographies*, 19(3), 284–290. <https://doi.org/10.1080/14733285.2020.1822516>
- Pepper, D. (2011). Assessing Key Competences across the Curriculum—And Europe. *European Journal of Education*, 46(3), 335–353.
- Pihkala, P. (2018). ECO-ANXIETY, TRAGEDY, AND HOPE: PSYCHOLOGICAL AND SPIRITUAL DIMENSIONS OF CLIMATE CHANGE: with Karl E. Peters, “Living with the Wicked Problem of Climate Change”; Paul H. Carr, “What Is Climate Change Doing to Us and for Us?”; James Clement. *Zygon®*, 53(2), 545–569. <https://doi.org/10.1111/zygo.12407>
- Pihkala, P. (2020). Eco-Anxiety and Environmental Education. *Sustainability*, 12(23), 10149. <https://doi.org/10.3390/su122310149>
- Pouru, L., & Wilenius, M. (2018). Tulevaisuuslukutaito navigaatiovälineenä kuudennessa aallossa: Kuinka integroida tulevaisuus lukio-opetukseen? *Futura*, 37(3), 12–23.
- Pramling Samuelsson, I., & Asplund Carlsson, M. (2014). *Det lekande lärande barnet: I en utvecklingspedagogisk teori* (2. ed.). Liber.
- Rasa, T., & Laherto, A. (2022). Young people's technological images of the future: Implications for science and technology education. *European Journal of Futures Research*, 10(1), 4. <https://doi.org/10.1186/s40309-022-00190-x>
- Rogers, M., & Tough, A. (1996). Facing the future is not for wimps. *Futures*, 28(5), 491–496. [https://doi.org/10.1016/0016-3287\(96\)00021-3](https://doi.org/10.1016/0016-3287(96)00021-3)

- Sachs, J., Kroll, C., Lafortune, G., Fuller, G., & Woelm, F. (2022). *Sustainable Development Report 2022* (1st ed.). Cambridge University Press. <https://doi.org/10.1017/9781009210058>
- Skolforskningsinstitutet. (2022). *Samhällsfrågor med naturvetenskapligt innehåll – en kartläggning av undervisningsmöjligheter. Systematisk forskningssammanställning 2022:01*. <https://www.skolfi.se/wp-content/uploads/2022/08/SNI.pdf>
- Sterling, S. (2014). At variance with reality: How to re-think our thinking. *Journal of Sustainability Education*, 6. http://www.susted.com/wordpress/content/at-variance-with-reality-how-to-re-think-our-thinking_2014_06/
- Sund, P., Gericke, N., & Bladh, G. (2020). Educational Content in Cross-curricular ESE Teaching and A Model to Discern Teacher's Teaching Traditions. *Journal of Education for Sustainable Development*, 14(1), 78–97. <https://doi.org/10.1177/0973408220930706>
- UNECE. (2011). *Learning for the future: Competences in Education for Sustainable Development*. United Nations Economic Commission for Europe. https://unece.org/fileadmin/DAM/env/esd/ESD_Publications/Competences_Publication.pdf
- UNESCO. (2020). *Education for sustainable development: A roadmap*. <https://unesdoc.unesco.org/ark:/48223/pf0000374802.locale=en>
- United Nations. (2020). *The Sustainable Development Goals Report 2020*. United Nations. <https://unstats.un.org/sdgs/report/2020/The-Sustainable-Development-Goals-Report-2020.pdf>
- Vygotsky, L. (1978). *Mind in society: The development of higher mental processes*. Harvard University Press.
- Wals, A. E. J. (2011). Learning Our Way to Sustainability. *Journal of Education for Sustainable Development*, 5(2), 177–186. <https://doi.org/10.1177/097340821100500208>