FACULTY OF EDUCATION
DEPARTMENT OF PEDAGOGICAL CURRICULAR AND PROFESSIONAL STUDIES

EXPLORING CLIMATE LITERACY: UNVEILING THE MOTIVATION AND SKILLS OF CLIMATE-LITERATE HIGHER EDUCATION GRADUATES

Jitka Charbonnier

Master's thesis:	30 credits
Programme/course:	S2ESD ESD700
Level:	Second cycle
Term/year:	Spring 2023
Supervisor:	Adrianna Nizinska
Co-supervisor:	Håkan Pleijel
Examiner:	Ilse Hakvoort

Abstract

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Keywords:	Climate Change Education, Adult Education, Illeris' Dimensional Learning, Graduate Skills, Climate Literacy, Adult Learning, Motivation for Learning about Climate

Aim: The purpose of this study was to investigate the perceptions, motivations, learning processes and use of graduate skills within the learning process about climate change by graduates.

Theory: The study applied Illeris' three-dimensional model of learning as a theoretical framework to explore the cognitive, emotional, and societal domains of adult learning, as well as the interconnection between them.

Method: A qualitative exploratory design has been used to collect data through semi-structured interviews with graduates within the context of Czechia who are motivated to learn about climate change.

Results: The study found that certain graduate skills, such as analytical and critical thinking, played a significant role in the learning process of adults regarding climate change since they were required to assess reliability of learning resources through their opinions. The social dimension was also highly important, with many participants being motivated and inspired to learn about climate change by conversations and interactions with others. Other sources of motivation stem from a sense of responsibility, feelings of guilt or fear. Graduates exercised several elements of pro-environmental behaviour and the study suggests educational institutions provide an ideal space to foster a culture encouraging this kind of behaviour. The results support that a holistic approach to learning in line with Illeris' three-dimensional theory of learning can successfully be used in designing educational training on climate change for adults.

Foreword

Three years ago, my son was born. It has been three years during which I see the world differently; for three years, I have had this never-ending feeling of responsibility towards the future of my son, humankind and, of course, this Planet. The birth of my child has changed the course of my ambitions and made me explore areas I have chosen to be blind about before. Luckily enough, driven by my personal curiosity and strong motivation to change the world, I have decided to pursue this master programme to widen my perspectives and to learn how to spread the message to others. Hence, studying motivation in relation to skills is a quest that represents journey in my own soul. Undertaking this study has made me reflect on my own experience of university studies as well as realize the utmost importance of education that is at the same my form of fight against climate change. I hope this research provides insights for educators and policy makers that are valuable and will be brought to practice or utilised for further research.

Acknowledgements

To begin with, I would like to give my thanks to all lecturers I had chance to come in contact within this master programme; I have encountered many wonderful people from all around the world, some of them I would never have the chance to meet that will hopefully develop in lifetime friendships. Participation in this international programme has also helped me to expand my perspectives and challenge my views.

I am sincerely grateful to my supervisor, Adrianna Nizinska, for all her invaluable advice, encouragements, and discussions; her guidance has carried me through all the stages of the writing process. I would also like to express my gratitude to my co-supervisor, Håkan Pleijel that has provided me with sincere feedback in the final stage of my writing process.

I am also thankful to my classmates whose support has been instrumental in this online program that provided me with so much needed informal interactions that have replaced an offline classroom setting.

I would also like to express my heartfelt gratitude to my family for their support throughout this journey and that they also took care of their grandchildren allowing me to pursue my academic goals, and for that I will always be grateful.

Finally, this endeavour would not have been possible without my husband, Vincent, who has provided me with imminent support and understanding. In addition to providing me with emotional support, he also gave generously of his time, making sacrifices in his own schedule to ensure that I had the time and space to focus on my research. Without his selflessness and dedication, this thesis would not have been possible. I am truly blessed to have him in my life.

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Introduction

According to the latest report released by Intergovernmental Panel on Climate Change (2023) global warming has been caused by humankind (p. 4). To slow it down, decreases in the amount of greenhouse gases being released into the atmosphere must be pursued (IPCC, 2023, p. 12). In 1992 at Rio Earth Summit, the United Nations have acknowledged that the cooperation of all people is necessary in order for efforts undertaken both locally and globally to succeed in slowing down global warming through Article 6 of the Framework; furthermore, it emphasized the importance of education and training in mitigating and adapting to disruption of climate (United Nations, 1992, p. 6).

By framing the Education 2030 agenda through Incheon Declaration encapsulating sustainable development goal 4 calling for action in the field of education, learning opportunities including lifelong learning are being promoted to achieve all other sustainable development goals and place education at the heart of the agenda (UNESCO, 2015, p. 24). In spite of the declaration, a report from a summit in 2022 stresses a crisis in education has emerged; education does not equip people with sufficient knowledge, values or skills that are cardinal to be able to adapt to the everchanging world and that "learning continues to underplay skills, including problem solving, critical thinking and empathy" (UNESCO, 2022, p. 1).

Despite childhood remains to be a period that is cardinal for one's formation, new knowledge on brain and connected neuroplasticity has revealed this potential to go further in adult age and as a result everyone, including adults, will be thrusted in a reality of a world with damages from climate change (International Commission on the Futures of Education, 2021, p. 38). Hence recognizing skills and experiences that transcend formal education might aid adults to better address challenges they face nowadays (UNESCO, 2022, p. 4).

During university studies that might have the potential to influence the direction the global society takes in the future (Rieckmann, 2012, p. 128) several skills are regarded to as crucial within higher education, for example analytical thinking and problem solving (Illeris, 2009, p. 72). Such skills are part of competencies that correspond to the predisposed skillset that is critical to face current sustainability issues (Wiek et al., 2011, p. 206). Unfortunately, at the moment skills acquired during university studies or *graduate skills* are researched from the point of employability and associated global market and neoliberal economics setting objectives connected to lifelong learning in the context of their utility in order to generate economic growth (James et al., 2013; Sinclair, 2017; Grugulis et al., 2004; Billing, 2007; Singh and Gera, 2015).

The aim of this thesis is to analyse perceptions of individuals interested in learning about climate change, their narratives or self-reported stories on the learning and the motivation processes to find out how they learn about climate change, to what extent or if at all do their skills acquired during university studies support their learning about climate change and whether having those skills makes them more confident as a learner; in addition, what motivates them to learn about it as well as their perceptions on climate change.

This research has a potential to inform education and environmental policy by identification of factors influencing skills and motivation of adults with higher education degrees to learn about climate change. Through this information, more effective strategies might be developed to engage this group in climate change education and encourage them to take action to address climate change. Furthermore, my research assists the broader goal of lifelong learning promotion by exploring the factors influencing adult learning.

Before reviewing literature, a background on *adult learning about climate change* and its current possibilities in both international and Czech contexts, formal and non-formal forms of education are introduced. By means of literature review, the field of adult learning about climate change discovered and addresses a notable gap in terms of skills gained through higher education studies and its utility in

the learning process about climate change. Terms related to climate change education and skills, such as *climate literacy*, *sustainability competencies* are introduced in addition to *graduate skills.* Before presenting results of the study, a theoretical framework proposed by Illeris (2011; 2012; 2017) based on three-dimensional learning together with Illeris' understanding of adult learning will be outlined and later engaged to study the conditions of learning in connection to engagement of dimensions in different situations and contexts. As the cornerstone of adult learning is according to Illeris its voluntary and selective nature in opposition to learning of children (Illeris and Rogers, 2003, p. 24). Next, different forms of learning are presented that precede the engagement of the three-dimensional model that results in competence, personality or identity development (Illeris, 2003, p. 405; Illeris, 2017, p. 127 - 129). The three dimensions are: *cognitive* focused on content of one's learning; *emotional* related to one's ability to balance external and internal inputs; and *societal* representing one's integration in different kinds of social interactions (Illeris, 2017, p. 25). In addition to the three-dimensions, the learning process is also influenced by outer context in which learning takes place (Illeris, 2017, p. 23 - 25).

Research Purpose and Questions

The purpose of this study is to explore adult's understandings about climate change, what motivates them to learn about climate change, what are the ways they learn about climate change and whether they regard university studies to be beneficial in this learning process by utilising *graduate skills*.

The participants of this study are adults with a higher education degree, that are Czech or currently live in Czechia, and are at the same time motivated to learn about climate change are participants of this study. To understand their perception on climate change, the first research question is defined as follows:

RQ1. What are adult's understandings about climate change?

Secondly, to uncover their motivations preceding the learning process:

RQ2. What motivates adults to learn about climate change?

Thirdly, to explore their learning process and means by which they learn about climate change:

RQ3. What are the ways through which adults learn about climate change?

And finally, to investigate whether their *graduate skills* are used as well as their role within their learning process about climate change:

RQ4. To what extent, if at all, do adults use graduate skills during their learning process about climate change? Do the graduate skills have a role within the learning process about climate change and if so, what is that role?

Overall, this research regards *graduate skills* from the context of their utility within their learning process about climate change and provides more insights into how this group might better be engaged in climate change education by investigating different aspects of learning situation.

Background on Adult Learning about Climate Change

Climate change is currently an issue becoming increasingly pressing and the need to address it through education is today profound resulting in proliferation of providing educational opportunities for adult learners within both formal and non-formal forms of education.

To begin with, among formal forms of education about climate change for adults belong various undergraduate or graduate programs connected to environment, climatology, chemistry, geography, physics or environmental science provided by universities. In the context of the Czech Republic these programs are provided mostly by public universities, such as at the Faculty of Natural Sciences at Palacký University Olomouc (n.d.), the Department of Environmental Studies at Masaryk University (n.d.) or the Department of Physics at Charles University (n.d.).

Within an international context, formal education focuses on climate change but at the same time also reaches beyond science-specific programs and overlays with other disciplines, such as 'Climate Change and Global Development' programme offered by the University of East Anglia (n.d.) in the United Kingdom, 'Sustainable Energy Systems' programme by Chalmers University of Technology (n.d.) in Sweden or 'Climate Change & Sustainable Finance' programme by Edhec Business School (n.d.) in France.

Non-formal education taking place outside of formal classroom setting offers a range of group, self-paced or experiential educational activities aimed on climate change for adults through various channels and activities, such as:

1. Workshops and webinars, held mostly by non-profit organizations (UNEP, 2023); (UNFCC, 2023)
2. Local activism opportunities (Extinction Rebellion, 2023)
3. Online learning platforms and other web-based resources Greenpeace, 2023); (Fakta o klimatu, 2023); (Člověk v tísni, 2023); (United Nations, UN CC: Learn, 2023); (edX, 2023); (Coursera, 2023)
4. Podcasts (BBC I The Climate Question, 2023); (TILClimate, 2023); (For What It's Earth, 2023)
5. Magazines (Atmos Magazine, 2023; It's Freezing in LA!, 2023; Časopis Veronica, 2023)
6. News with sections on climate (UN News I Climate and Environment, 2023); (New York Times I Climate and Environment, 2023); (NASA I Global Climate Change, 2023); (CNN I Climate, 2023); (The Guardian I Climate Crisis; 2023); (BBC I Climate, 2023); (ČT24 I Klimatická změna, 2023); (aktuálně.cz I klimatické změny, 2023)
7. Documentaries and streaming platforms.

Since there is a big variety of informal resources in English, in the Czech context utilising English language might represent an advantage for adult learners during their learning process due to both amount, range and reliability of resources. According to the latest report by Stetka (2022) for Centre for Media Pluralism and Media Freedom (CMPF) under the European University Institute (EUI) market plurality represents a high-risk area within publishing due to the influence of commerce and ownership over content. It mentions the Czech oligarch and ex-Prime minister of the Czech Republic, Andrej Babiš as the most known case of "conflict of interest" (p. 10). Besides, since there is a lack of restrictions in terms of cross-media ownership, low transparency of media ownership (Stetka, 2022, p. 11-12) as well as medium risk of media literacy (p. 15), the likelihood of disinformation underlying political and commercial conditions remains medium to high.

To conclude, while there are numerous educational opportunities within both formal and non-formal educational settings available focusing on providing knowledge, current development and other types of information about climate change, there is a lack of emphasis on skills, including those of graduates, their impact and development during the process of learning about climate change in non-formal settings.

Literature Review

The focus of the following literature review is aimed to provide different viewpoints and contexts on the phenomena of *adult learning about climate change* as well as to develop valid definitions of *graduate skills* this research onward and address a possible gap in a previously conducted research.

The chapter starts with a review of studies published on the topic of *adult learning about climate change*. The next two subchapters of the literature review, on *climate literacy* and *sustainability competencies*, help to define views on knowledge and skills related to climate change and sustainability drawing on the second part of *RQ3*, which inspects the interaction between skills and the learning process about climate change. Finally, reviewing the definition of graduate skills, connects the first part of *RQ3* by allowing the intersection of *graduate skills*, or skills acquired during higher education studies, with previously reviewed skills connected to climate change through *climate literacy* and *sustainability competencies*.

The resources used for the literature were obtained mainly through research databases, such as Scopus, Education Research Complete or Education Collection, and the source types ranging from research articles to official reports to scholarly books. The keywords utilised in database searches were connected to intersection of adult learning, motivation, education and skills in relation to climate change to ensure high relevancy of chosen resources, e.g. climate change education, graduate skills, climate literacy, adult learning, motivation for learning about climate or sustainability competencies.

In addition, within the first subchapter presented earlier, about *adult learning about climate change*, a common search engine, Google.com, was used to supplement database search for non-formal ways of learning about climate change for adults that are easily accessible by the wider public to help map what kind of resources are available. Within this area, the results prompted by the search engine were inspected, but not drawn upon for content, rather referred to a list, for example a list of podcast shows about climate change.

In conclusion, this chapter aims to identify gaps in each section of the literature review, inspect the background and different views on a specific terms or problematics, and define terms that will be used within this paper. The information gained from this chapter will later be utilised within the analytical part of this thesis to help support the interpretation of results.

Exploring Adult Learning on Climate Change: A Review of Studies

There are a lot of perspectives and contexts from which adults learning about climate change is regarded; most of the research is focused on behaviouristic elements of this learning as well as motivation and communication.

Some authors study adult learning about climate change to track differences in different groups through examining their pro-environmental behaviour. Nelson et al. (2022) claims education needs to be supplemented by other influences, such as integration within a certain community or sharing values to be able to effect environmental behaviour in a positive manner (p. 1). Nelson et al.'s (2022) study has proven participants have improved their confidence in "making a difference as well as a strong interest" (p. 15) through examining results of participation in courses in adult climate education (p. 5).

Similarly to Nelson et al. (2022), Pöllänen et al. (2023) point out the need to include internal human dimension in order to help transform the society and achieve sustainable development (p. 1). Represented by behaviours, cultures, or society a person is surrounded by, interaction between these inner processes and external ones is cardinal to be able to lead to transformation (p. 11 - 12).

A different view on the problematics has taken Whitmarsh (2008) that studied whether people living in risk areas from flood differ in terms of their knowledge, attitudes or behaviour compared to those in

non-risk areas (p. 351). As a result, Whitmarsh (2008) finds out participants' experience does not play a significant role in their perceptions but reveals their pro-environmental values are higher hence undertake an appropriate action (p. 369).

Another study by Colombo et al. (2023) sees the gap between attitudes and pro-environmental behaviour to lie in self-regulation through mindfulness and nonjudging factors (p. 9) and claim nonjudging "could improve individual coping strategies when faced with the environmental crisis and prevent negative emotions from interfering with behaviours aimed at addressing the environmental threat, which is in line with findings indicating fear and helplessness as major barriers to adopting pro-environmental behaviour" (p. 8). The authors further propose self-regulation activities to be promoted together with awareness campaigns to spark pro-environmental behaviour of public (Colombo et al., 2023, p. 8).

Gifford and Comeau (2011) have studied influences of motivational versus sacrifice framing on sustainability competencies (p. 1301). The research has proven motivational framing to have a more positive impact on developing sustainability competencies and demographic factors contributing to generalization of results as well, mostly through gender and age (Gifford and Comeau, 2011, p. 1305).

Yet another study by Leiserowitz et al. (2021) recommends a way of how to best communicate climate change with different adult audiences splitting public in six groups or *Americas* based on the way they respond to climate change (p. 97). The alarmed group believing in human-induced climate change and being the most concerned about the issue that Leiserowitz et al. (2021) defines as the most motivated and also associates it with higher level of education (p. 98).

In connection to motivation, Mohamad et al. (2023) emphasise the role of motivation as a mediator in the learning process within sustainable development training in the workplace (p. 1). Above all, it implies strategies of communication and motivation to be decisive factors in possible triggering one's motivation to learn (p. 16).

Overall, studies about adult learning about climate change are focused on how this learning is influenced by behaviouristic elements as well as motivation and communication. For some, motivation plays a significant role in the learning process, and other studies investigate other elements that influence learning and pro-environmental attitudes. While the studies in this chapter discuss elements that are beneficial for the learning process of adults, this study addresses the impacts of university studies in the form of graduate skills and other influences that help explain the role of tertiary education in adult learning about climate change.

Climate Literacy

To begin with, climate literacy is a term that might be described in the reviewed literature as *climate change literacy* or *climate science literacy*. Within this study, these terms will be united under the term *climate literacy*. The definition of climate literacy is not unified; Helbling et al. (2021) define climate literacy as "knowledge about climate change" (p. 2). Ledley et al. (2014) focus more on one's individual action, proposing the definition of climate literacy as "an understanding of your influence on climate and climate's influence on you and society" (p. 309). Following the epistemic interpretation of climate literacy, several studies connect climate literacy directly with science literacy (Bybee, 2012; Fauville et al., 2015; McCaffrey and Buhr, 2008), such as ocean, weather or energy literacy (Azevedo and Marques, 2017, p. 417).

Dupigny-Giroux (2010) lists one's "ability to assess the validity of scientific arguments about climate" (p. 1204) as a bridge between knowledge and skills in understanding of a climate-literature person. Liu et al. (2014) also state the need to "know how to assess scientifically credible information about climate" (p. 31). Furthermore, Powers et al. (2013) point out the need to engage problem-solving and decision-making skills as well as critical thinking within climate literacy education (p. 23.928.3). In addition to

skills, Ledley et al. (2014) also suggest that a person that is climate-literate "communicates about climate and climate change in a meaningful way" (p. 309).

By virtue of engaging climate literacy, Kolenatý et al. (2022), who understand climate literacy as knowledge, point out climate literacy to be a predisposition for climate action (p. 1) and list it as one of the motivational factors alongside attitudes or beliefs to act in favour of climate (p. 2 - 3). Furthermore, Helbling et al. (2021) conducted a research in Africa showing that climate literacy affects the intensity of migration (p. 2) and especially among those citizens aware of not only causes but also possible impacts of climate change (p. 8 - 9).

Within the learning environment, a transformative learning approach should be taken to enable empowerment and motivate students to act pro-climatically (Kolenatý et al., 2022, p. 4). In addition, introducing scientific topics through projects with a student-centred approach allows students to engage skills connected to climate literacy, particularly critical thinking and problem-solving (DeWaters et al., 2014, p. 470); DeWaters et al. (2014) have implemented modules aimed at climate change through projects in middle and high school and proven they influence positively cognitive and affective learning domains as well as behavioural aspect as a direct result of such activities (p. 479 - 482).

Aside from formal setting for engaging activities supporting climate literacy, in *Climate Literacy and Innovations in Climate Change Education* (2018) several authors (Chirambo, Chapter 3; Hassal, Chapter 22; Nuutinen and Leal Filho, Chapter 5; Otto, Chapter 8; Wolf et al., Chapter 1) stress the connection between climate literacy and Information and Communication Technologies (ICT) and how it advantages, empowers and facilitates the learning process leading to become more climate literate in specific areas linked to climate change, such as agriculture, health or climate change in general. The forms in which the learning in online space occurs is, for example, through various online learning platforms (Chirambo, 2018, p. 44-45), massive open online courses (Wolf et al., 2018, p. 1; Otto, 2018, p. 131), online communities via web foras, social media groups or webinars (Nuutinen and Filho, 2018, p. 67) and even online drama education (Hassal, 2018, p. 379).

The topic of climate literacy is not new in the Czech Republic since the Ministry of Environment of the Czech Republic has proposed in an educational guide a framework for reaching climate literacy through different age groups corresponding to various level of formal education from elementary to higher education in three domains: knowledge, skills and attitudes (Daniš et al., 2021, p. 15). In addition, throughout the guide by Daniš et al. (2021) the need for critical thinking and media literacy is emphasised as well (p. 10).

To summarise, most of the literature reviewed for this thesis focuses on the general meaning or implementation of climate literacy in various environments and contexts. Nevertheless, it lacks a specific focus on the intersection of graduate skills of adults and skills connected to climate literacy.

Sustainability Competencies

Sustainability competencies in literature are expressed in a vague and ambiguous manner leading to counterproductivity in the field of Education for Sustainable Development (Redman and Wiek, 2021, p. 1) with no consensus among scholars on what the essential set of competencies in sustainability should be (Rychen and Salganik, 2003, p. 7; Rieckmann, 2012, p. 129; McCarthy and Eagle, 2021, p. 10). Redman and Wiek (2021), on the other hand, claim that despite it might appear otherwise, there is a certain agreement on *sustainability competencies* students should possess (p. 1). From the introduction of the term *competency* over twenty years ago it has gradually replaced its synonyms, such as *literacy* and *attributes* (Redman and Wiek, 2021, p. 3 - 4).

In 2003, OECD's project *Definition and Selection of Competencies* (DeSeCo) (Rychen and Salganik) was introduced with a goal to shed light on the term *competence* and what *key competencies* comprise of (p. 7 - 8). *Competency* is introduced to go beyond the traditional understanding of knowledge and skills but to include different abilities that are already possessed by an individual to be engaged in different contexts (OECD, 2005, p. 4). *Key competency*, on the other hand, is a part of a small set of competencies that is valuable and contributing to both an individual and a society while addressing different requests applicable to various contexts (OECD, 2005, p. 4). Through the DeSeCo project (OECD, 2005) key competencies were classified into three interrelated categories:

1. Interactive use of tools – e.g. language, text or technology; being reflective about tools and their organisation, being able to evaluate them and their sources
2. Taking independent or autonomous action – e.g. setting one's own action within a wider context; future-orientation of an individual through engaging project management; being able to decide about one's needs, interests, rights as well as limits
3. Engaging in interactions within groups that are not homogenous – e.g. taking different perspectives through empathy; self-control of our emotions, presentation, negotiation and decision-making skills leading to better in-group cooperation; conflict resolution.

(OECD, 2005, p. 5 - 15)

Furthermore, to the three previously introduced categories, certain feature might be found across all three, namely thinking independently, being able to reflect through our thoughts and actions and taking responsibility for both our actions and our learning process (OECD, 2005, p. 8).

Another approach taken by de Haan is forming several key competencies into *Gestaltungkompetenz* or *shaping competence* created for purposes of Education for Sustainable Development meaning "the specific capacity to act and solve problems" (p. 22). De Haan (2006) emphasises this competence-oriented approach to education serves as a shift to refocus from input to output and naturally prompts to rethink the structures through problem-solving and abilities one should acquire rather than traditionally understood syllabus focused on the content of learning (p. 22). The key competencies de Haan (2006) lists are based on interdisciplinarity, planning for future-oriented thinking and actions, thinking and acting in global context, participatory skills, being able to empathize, motivating self and others as well as reflect on different phenomena (p. 22 - 25).

Rieckmann (2012) describes *competencies* as "the dispositions which individuals need in this environment for acting and self-organisation in various complex contexts and situations" (p. 129). Nevertheless, there is a difference between a competency and a key competency, since key competencies are those of importance, deemed essential for achieving objectives within a given normative framework, such as sustainability (Rieckmann, 2012, p. 129). Later in the paper, Rieckmann (2012) reflects on the role and importance of higher education in relation to sustainable development (SD) (p. 128) which might help develop *key competencies* connected to SD, such as "systemic thinking and handling of complexity, anticipatory thinking and critical thinking" (p. 134).

Despite several authors have studied connections between sustainability, sustainable development or Education for Sustainable Development and the corresponding competencies (Rychen and Salganik, 2003; de Haan, 2006; Rieckmann, 2012; Glasser and Hirsch, 2016), as the paper having had the greatest impact, or , in other words, the most frequently cited (Grosseck et al., 2019, p. 13) was identified Wiek (2011) that has published a reference framework that was widely engaged by the academic community as well as applied in teacher training and university programs (Redman and Wiek, 2021, p. 4). Although Redman and Wiek (2021) claim some research papers have not used the framework to its full potential, they have decided to extend the original framework by another three *emerging* competencies that are applicable in interdisciplinary manner (p. 5) and present a unified framework of *sustainability competencies*.

The original set of competencies comprises of the following *competencies*:

1. Systems-thinking – i.e. being able to analyse different structures, systems or problematics across multiple scales through different modelling, mapping or another forms of analysis
2. Anticipatory – i.e. to use scenarios or methods in connection to possible anticipation of sustainability problems, such as its mitigation
3. Values thinking – i.e. through engaging one's knowledge of concepts such as sustainability, SD, and concepts within including values and principles to assess sustainability issues within problem-solving situation as well as to relate to one's own decision-making processes, such as choosing a profession
4. Action-oriented – i.e. planning and carrying out actions leading to the ability to think strategically towards reaching a more sustainable world
5. Interpersonal – i.e. engaging interpersonal relations through communication, empathy, negotiation as well as leadership skills to achieve the full potential of the previously defined competencies

(Wiek, 2011, p. 243 - 252).

The *emerging* competencies that expand the original set of competencies are according to Redman and Wiek (2021) the following:

6. Intrapersonal – i.e. relating the interpersonal competence to self, e.g. through self-care in order to avoid situations hindering the advancement of sustainability solutions
7. Integration – i.e. engaging problem-solving skill to complex issues connected to sustainability through developing and implementing strategies as well as promoting them through decision-making
8. Implementation – i.e. an advance level of action-oriented competence that focuses on all stages of strategy and action plans from design through test phase to implementations; reflecting on all possible situations, such as barriers or dependencies

(Redman and Wiek, 2021, p. 5 - 6).

To put my work in the context of the reviewed literature, rather than focusing on the definition of competency and what it comprises of, leaving both considerations open it addresses its development within higher education as well as its deployment within the learning process about climate change. Within this work, *sustainability competencies*, when addressed, will be related to the expanded version of Redman and Wiek (2021). In addition, competency will be revisited in the theory chapter in relation to Illeris' understanding of learning.

Graduate Skills

James et al. (2013) distinguish between *graduate skills* that are specific for each learning discipline, such as to seek solutions for problem in mathematics, and *skills of graduates* that are acquired alongside studies in either work, university or family environments not directly connected to studied discipline (p. 953). Within this study, the definition of *graduate skills* is a blend of these two understandings, hence *graduate skills* are skills acquired during higher education studies both inside and outside school environment, therefore not only connected to the formal learning process but associated family, living and working situation.

During formal higher education, a distinction in terms of skills acquisition might be introduced dividing skills in two categories: generic and domain-specific skills. Generic skills are also called interactive or soft (James et al., 2013, p. 957). Grugulis et al. (2004) introduce problem-solving, team work or refining own's learning process as key skills (p. 2). Troitschanskaia and Kühling-Thees (2019) list the ability to

think critically and take own perspective to be one of the key elements of generic skills (p. 286) aside from domain-specific skills that provide expertise in a certain domain.

Billing (2007) focuses on transfer or arousal of generic skills and implies a close relationship between motivation and belief systems of students to have a direct impact on skill and knowledge acquisition (p. 499). Both of these relations were confirmed by Martínez-Roget et al. (2020) that emphasise students with personality traits, such as curiosity, to have an immense influence on the potential to acquire competences (p. 5). Apart from this, Martínez-Roget et al. (2020) have discovered motivation to determine overall academic performance (p. 3), hence acquisition of skills as well.

In addition, mathematics taught alongside university studies not necessarily as a main subject but rather as a complementary element to generic and domain-specific skills might be applied to all areas of one's life including values (Albayrak et al., 2017, p. 148). Hence, mathematical thinking might serve as a problem-solving method training individuals to think in analogies and exercise argumentation (p. 149). Tricot and Sweller (2013) conjoin problem-solving with domain-specific rather than generic skills (p. 6). To avoid this confusion, the term graduate skills within this study will be used in the context of skills that were consequently acquired within the previous conditions of environment as well as within both domain-specific and generic skills without questioning whether they were acquired directly or indirectly to the studied subject area of participants.

Apart from an uneasy quest to define graduate skills themselves, there is a growing body of literature focused on graduate skills or generic skills in connection to *employability* meaning one's ability of being employed (James et al., 2013; Sinclair, 2017; Grugulis et al., 2004; Billing, 2007; Singh and Gera, 2015). Sinclair (2017) provides a list of employability skills including team work, organizational ability, problem solving skills, adaptability or communication (p. 55). What is valued most by employers is to be able to transfer and utilize their knowledge to various situations (Sinclair, 2017, p. 55). Grugulis et al. (2004) add to this list "leadership, motivation, positive attitudes towards change" or responsibility (p. 6 -7). In addition, Grugulis et al. (2004) highlights the shift of view on these phenomena from, for example, traits connected to one's own personality or predisposition to skills and concludes the skill problematics to be a very broad and unclear topic (p. 14).

Overall, it appears that graduate skills is a complex and highly intricate subject with many studies that discuss them in connection to their generic and domain-specific nature as well as their relation to employability. Nevertheless, there is a gap in research examining the intersection of graduate skills and their utilisation during a learning process about climate change.

To conclude, the literature review on adult learning about climate change reveals that most studies focus on behaviouristic elements, motivation, and communication. While some studies emphasize the importance of community learning, some discuss values that lead to promotion of pro-environmental behaviour, such as self-regulation and mindfulness. Motivation was identified to be a crucial factor in the learning process and the need for recognizing different adult audiences to decide on effective communication strategies was recommended as well. The concept of climate literacy was explored through different definitions, but in general encompasses understanding of personal impact and knowledge in connection to the ability to assess credibility of information about climate change. Next, the literature review also discussed various approaches to defining sustainability competencies and the mostly accepted by scholars is framework proposed by Wiek (2011) including systems thinking, anticipatory thinking, anticipation, values thinking, action-oriented thinking and interpersonal skills (p. 243 - 252). This framework was also completed by emerging competencies, namely intrapersonal, integration and implementation skills by Redman and Wiek (2021, p. 5 - 6). Graduate skills and their intersection with previously reviewed climate literacy and sustainability competencies have been minimally explored in the literature that has focused rather on its connection to employability. Hence, through the means of literature review a gap has been identified that would address the need for understanding the role of tertiary education in adult learning about climate change and to it associated development of skills beneficial within the learning process.

Theoretical Framework

This chapter aims to uncover the understanding of the term *adult learning* through the lens of Knud Illeris and introduce a theoretical framework proposed by Illeris, *The Three Dimensions of Leaning* as well as Illeris' understanding of competence.

The purpose of this chapter is mainly to present a theory that will be used for the upcoming analysis and interpretation of results as well as to explore the connection between Illeris' framework and how the introduced dimensions might be mapped in connection to the skills and motivation of adults with higher education degrees to learn about climate change. The three-dimensional model will serve as an epistemological lens to place the results of the research within this framework; each of the domain will be studied within the set context for the learning process about climate change. In addition, the framework and its structure will be challenged in a discussion to reveal whether all presented domains are necessary for the initiation of participants' learning process.

To give a historical background, presenting *The Three Dimensions of Learning* in 2003, Illeris has focused on discovering the conditions of adult learning and published several articles on the topic. One of them represents a discussion between Illeris and Rogers challenging Illeris' view that differentiates *adult learning* from learning by children or *children's learning* (*Understanding the Conditions of Adult Learning,* 2002; *Towards a Contemporary and Comprehensive Theory of Learning,* 2003; Illeris and Rogers, 2003, *How Do Adults Learn?*). In 2007, Illeris published a book *How We Learn* that was later revised and followed by a second edition in 2017.

In the beginning of this section, the term *adult learning* will be defined together with its characteristics as well as how it differentiates from *children learning* or the way in which children learn. Afterward, different forms of learnings will be presented alongside what aspects they comprise of and for which stage of life they are more common. Next, Illeris' *three-dimensional learning model* will be introduced together with description of each dimension. In the final part of the chapter will be presented view of Illeris on the *competence* concept and how it relates to the previously introduced understanding of learning.

Adult Learning

To begin with, it is important to note *learning* is a complex process that is naturally occurring and might be described as inevitable since it might happen unconsciously or even forced given current societal norms and standards (Illeris, 2017, p. 1).

Mostly voluntary in nature (Illeris, 2017, p. 196) *adult learning* leads to capacity change that is permanent, "not solely due to biological maturation or ageing" (p. 3). Illeris (2003) points out a characteristic of adulthood to be to take charge of one's own learning process making conscious or subconscious decisions and be responsible for the outcomes of such learning (p. 405). Since a part of this decision becomes fundamental for adult learning to be meaningful, relevant and interesting as well as to directly affect one's own set of goals, it represents elements of selectivity unique to adulthood (Illeris, 2017, p. 195 - 196).

Within a discussion between Illeris and Rogers (2003), Illeris highlights the motivational aspect to be the most important distinguishment of adult learning from *children learning* with adults not being reliant on anyone else for their survival, demonstrating their high degree of independence, in comparison to children (p. 24). Influenced by culture that plays a major role in the development of motivation, there is a gradual restriction on perspectives we bring to adulthood (Illeris and Rogers, 2003, p. 26). The understanding of *motivation* within adult learning that Illeris presents is in its sense *intrinsic*, which means that it is less probable to be forgotten and has a higher potential to be applicable than *extrinsic motivation*. In addition, Illeris (2003) claims that children learning is mostly driven by extrinsic

motivation, defined also by the incapability and disinterest to be an autonomous learner (Illeris and Rogers, 2003, p. 25; 27).

Forms of Learning

Stemming from different typologies, such as Piaget and Mezirow, Illeris (2003; 2017) outlined different levels of learning taking place prior to the three-dimensional dimensional model of learning that is based on the assumption some of the following learning takes place:

1. Cumulative
2. Assimilative
3. Accommodative
4. Transformative

(Illeris, 2003, p. 402).

Cumulative Learning

The cumulative form of learning involves memorizing isolated or new pieces of information and is more common to be engaged in the childhood but can also occur in adulthood when learning without context or personal interests or experience (Illeris, 2003, p. 402). The result of such learning is often automatic recall of learned information and its application in situations comparable to those within which learning took place previously (Illeris, 2003, p. 402). To give an example, Illeris (2017) brings up a telephone number, a part of which will always be new, learning a new vocabulary or other rigid activity and calls cumulative learning as "learning by heart" or *mechanical* (p. 37).

Assimilative Learning

The next form of learning is assimilative, a cornerstone of traditional education building mental schemes in connection with certain subject that is also called *additional* (Illeris, 2017, p. 37 - 39). Being based on extending and adapting an already acquired knowledge in a new situation in a steadily and in a stable manner, Illeris (2017) claims this form of learning to be present within our daily life routines (p. 37 - 38). Despite its frequent use, Illeris (2003) stresses the inflexibility accompanying assimilation that many times results in students' inability to think systematically and interdisciplinary (p. 402) as well as limitations to live in today's everchanging world (2017, p. 38).

Accommodative Learning

Yet another form of learning, sometimes defined as *transcendent*, is characterised by solving a problem through recontextualization even though this process might be both short and lengthy (Illeris, 2017, p. 38). As opposed to *cumulative* and *assimilative learning*, in spite of being exposed to the same external conditions, it reflects one's individual understanding and our personal ways of perception and interpretation of various subjects giving rise to our diversity (Illeris, 2017, p. 39 - 40). Nevertheless, Illeris (2003) states this process of learning to be mentally demanding, or even painful requiring to redefine one's own limitations (p. 402).

Transformative Learning

In addition to the other forms of learning, a particularly special role represents also *transformative* or *expansive learning* allowing *meaning perspectives*, representing one's own creation for different phenomena (Illeris, 2017, p. 59), that are mostly developed within stages of life preceding adulthood and carried on to later life to operate on an unconscious basis, to be reshaped and reviewed as a result of such learning with high involvement of emotions (Illeris, 2017, p. 59). Illeris (2003) claims this type of learning results in alternation to one's personal identity and sense of self (p. 403).

To sum up, *assimilative* and *accommodative learning* are the two common forms of learning used every day (Illeris, 2003, p. 402). In terms of age, *cumulative learning* occurs mostly in childhood and *transformative* rather in adulthood when one's own identity is already established hence the

transformations in one's thinking might take place (Illeris, 2003, p. 402 - 403). Illeris (2003, 2017) points out *assimilation* to be the most used learning form not only for the tradition of teaching practice but also because of the tendency to avoid cognitive overload and as a result resist other types of learning (2003, 403 – 404; 2017, p. 45).

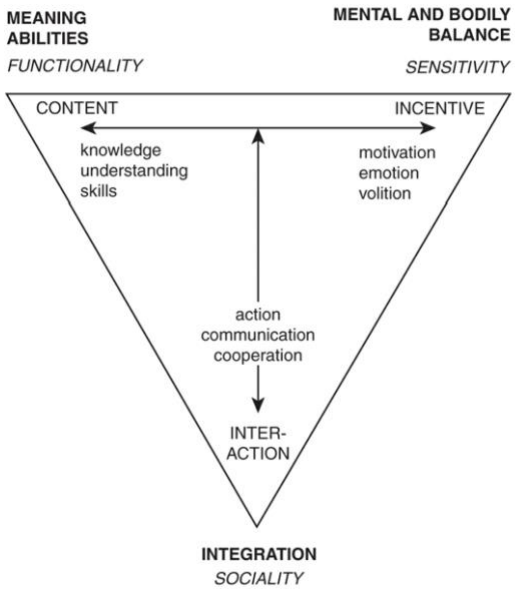
Consequently, Illeris challenges the traditional theory of learning that emphasises the role of cognitive dimension (Illeris, 2003, p. 405) by presenting a theoretical framework aiming at uncovering competence development called *The Three Dimensions of Learning*. Illeris (2003) declares that in today's developed world there is an increased need of competence, mostly in terms of working life (p. 397) and hence valid for adult learning, that requires more than traditionally acquired knowledge but also within a context of personal qualities and other skills used in everyday life represented through societal and emotional dimension (p. 397; 405).

Illeris' Dimensions of Learning

For learning to happen Illeris (2003) claims two processes need to be active; firstly, the one occurring between a learner and his external surroundings; secondly, the one occurring in the learner internally (p. 398). These processes, internal in the upper part and external in the bottom part of the triangle are represented by double arrows within **Figure 1**; at the end of the arrows, terms in italic represent names of each dimension. By means of engaging terms in bold in **Figure 1** within each of the dimension, terms in **Figure 1** in italic represent a result of such engagement. In addition, learning goals, or parts of what a certain dimension comprises of, are expressed by three keywords for each dimension in **Figure 1**.

Figure 1.

The Three Dimensions of Learning



Note. Illeris (2017, p. 27). Copyright by Routledge.

Three Dimensions of Learning

The Cognitive Dimension of Learning

The first dimension within the model for competence development by Illeris is *cognitive* or *content* representing the content of our learning process that aims to construct certain abilities or meaning to be able to function within different situations we may happen to be involved in (Illeris, 2017, p. 25). As

examples of what the cognitive dimension comprises of, Illeris (2017) proposes "knowledge, skills, understanding, attitudes, behaviour, sociality and empathy" (p. 25). This understanding of learning is the most imminent within traditional education (Illeris, 2017, p. 25). Illeris (2017), on the other hand, emphases its interaction with incentive or emotional dimension that happens simultaneously with impulses coming from the societal dimension (p. 25).

The Emotional Dimension of Learning

The second dimension of the three-dimensional learning model is *emotional* or *incentive* aiming to battle imbalance of one's mind and body through developing one's sensitivity to both external and internal inputs and comprises of "motivation, emotion and volition" (Illeris, 2017, p. 25). Illeris (2017) regards this dimension to be a driver, or "the mental energy that is the driving force of learning" (p. 89). Above all, Illeris (2017) emphasises emotional dimension must be integrated in learning since it might influence its results (p. 89 - 90).

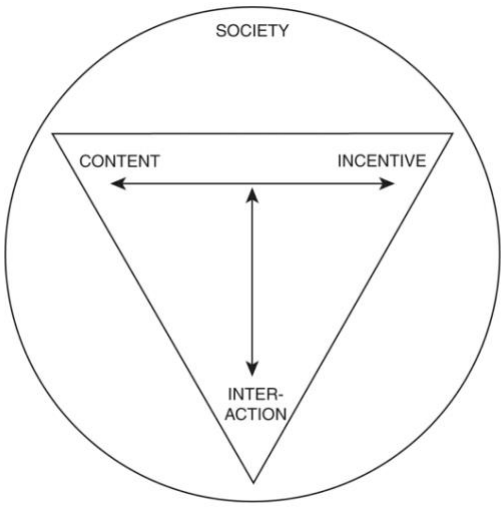
The Societal Dimension of Learning

The third dimension within the triangular module for competence development is *societal* or *interaction* dimension that promotes one's integration by means of reaching the ability to socialize within different kinds of social interaction relevant for one's context within their own community or, in a broader sense, society (Illeris, 2017, p. 25). As a result of one's *sociability* is reached through "action, communication and cooperation" (Illeris, 2017, p. 25) an individual fulfils his potential to function within their environment that might be of both social and material nature from close to general levels of context (p. 25). This external process of *interaction* is tightly connected and sends impulses to the cognitive and emotional domains (Illeris, 2003, p. 399).

In addition to the model introduced previously, it is important to mention the need for defining the learning situation graphically expressed by a circle in **Figure 2** within its context that has a direct impact on the learning process and its effectiveness (Illeris, 2017, p. 23). According to Illeris (2017), the context is inherently multi-layered through identification of learner's environment within their present condition and the reason of the learner's involvement "to the activities or institutions of which the situation is a part, the geographical, social and cultural environment, and the superior national and global framework" (p. 23 - 25).

Figure 2.

The Three Dimensions of Learning within Outer Context



Note. From Illeris (2017, p. 25). Copyright by Routledge.

Results of Learning

According to Illeris (2017) there are three possibilities that emerge from the learning process tightly intertwined with learning theories (p. 116), namely the *personality*, the *competence*, and the *identity* (p. 116).

Stemming from vocational meaning such as qualification (Illeris, 2017, p. 126), competence is a contemporary concept (p. 116) that comprises of not only epistemically understood knowledge and skills but also personality traits and one's ability to respond adequately in any life situation (Illeris, 2003, p. 396). Engaging competence means to take a unified approach to this situation (Illeris, 2017, p. 126). Nevertheless, Illeris (2017) points out the complexity around defining and implementing the concept of competence (p. 126) mostly as a result of the fact that "a number of national and supranational bodies have taken over the concept and sought to implement it as a management tool" (p. 126 - 127). Despite economic interests surrounding competence, Illeris (2017) believes in its potential to contribute to the understanding of learning as well as emphasises it to be cardinal in today's world (Illeris, 2003, p. 397).

Above all, Illeris (2017) claims competence not to be a result of learning but more a goal towards which learning process should be directed and identifies *personality development* or *identity* to represent an outcome of learning (p. 128 - 129).

Within holistic learning, personality is regarded as another concept and relates to whole through all dimensions in connection to different qualities, hence regards a person from the outside (Illeris, 2017, p. 123; 129). Identity, on the other hand, is being addressed within the intersection of external and internal learning process that might further lead to identity formation (Illeris, 2017, p. 130).

Method

This chapter focuses on the methodology chosen for this study in order to collect and further analyse data to help answer research questions. In the first part of this chapter, the research design and reason for choosing this particular design will be explained. Next, the second chapter will reveal a strategy chosen for sampling together with decisions on which the sampling criteria have been based. Another part of methodology covers ethical aspects and considerations taken in connection to conducting this research. Finally, research method together with data collection specifics and tool will be introduced with presentation of how data were analysed.

Research Design

This is a qualitative exploratory study. There are several reasons for choosing this research design. Firstly, in relation to epistemology, it is to respect participants' individuality and surroundings by giving an opportunity to examine their own interpretation of their experiences (Bryman, 2012, p. 380). Secondly, theoretical framework utilised within this research serves as epistemological lens through which the results of the study are regarded on rather than what precedes the research, hence interpretation of theory represents more an aid than a necessary predisposition (Bryman, 2012, p. 380; 384). Thirdly, in relation to ontology, taking a perspective of participants' experience through meaning-making (Bryman, 2012, p. 380). Above all, since a gap has been identified within literature review on the topic of adult learning about climate change in relation to graduate skills, Bryman (2012) implies exploratory stance to be a better choice that is in agreement with qualitative, not quantitative, research (p. 41).

Sampling & Study Participants

Before reaching out to participants, the sampling strategy has been developed in agreement with Robinson's four-point approach to qualitative sampling. See the adaptation of Robinson's four-point approach in **Table 1**.

Table 1.

Adapted Sampling Based on Robinson's Four-Point Approach to Qualitative Sampling

Point	Name	Decision	Application to research
1	Sample universe	Inclusion Demographic Geographic	 Adults with Higher Education Degree Czechia
2	Sample size	Idiographic	5-15
3	Sample strategy	Purposive	As per sample universe
4	Sample source	Advertising	Facebook group: Living in Brno Personal Facebook profile status

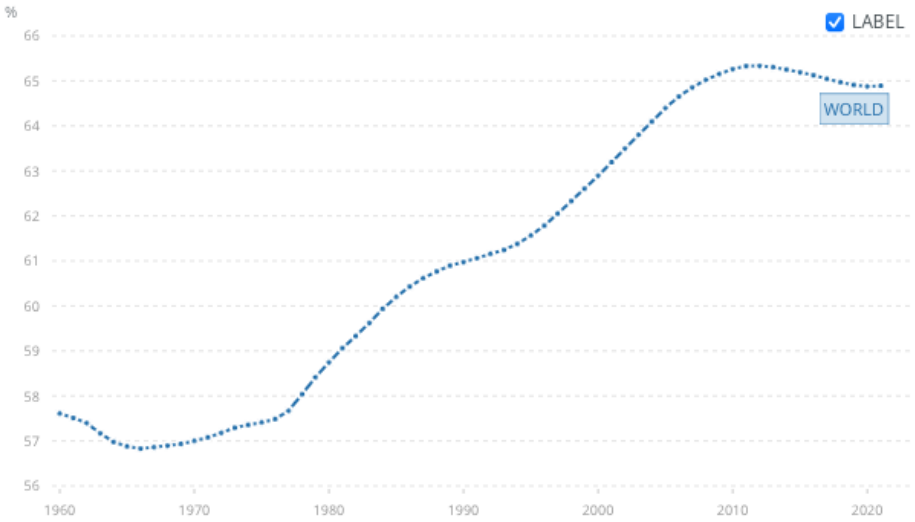
Note. Adapted from Robinson (2014, p. 26). Copyright by Routledge.

The study participants of this study were adults with a higher education degree, ranging from bachelor to doctoral level, that have studied, but not necessarily come from, or live in, the Czech Republic.

Two decisions are behind choosing the adult age group to be included in the sample universe. Firstly, the reason is that the proportion of adults in the context of global population, has been increasing gradually from last century compared to other age groups of children and seniors, see **Figure 3**. For this reason, seeing trends in representation of adults within global population is seen as a potential and an important group to be studied.

Figure 3.

World Population Ages 15-64 from 1960s to 2022.



Note. In *The World Bank Data* by United Nations Population Division. World Population Prospects: 2022, https://data.worldbank.org/indicator/SP.POP.1564.TO.ZS?end=2021&start=1960&view=chart. Copyright 2022 by United Nations Population Division.

Secondly, according to UNESCO Institute for Lifelong Learning (2010), adult education and learning are essential in creating societies that are sustainable (p. 7) proving this group is adept to be studied in order to help understand how this age group might face current sustainability challenges and respond to the effects of climate change.

Next decision taken when choosing sample universe was to include people with higher education degree; the reason for such choice lies in the fact that certain skills in higher education, such as analytical thinking and problem solving (Illeris, 2009, p. 72) are included in a list of key competencies that are crucial in addressing present sustainability challenges (Wiek et al., 2011, p. 206). In addition, there is a possible involvement of this group in political participation, politics or decision-making activities as argued by many (Willeck and Mendelberg, 2022, p. 90). Hence, studying this group represents potential climate advocates that are able to address sustainability challenges through their skillset, such as climate change and also influence future decisions regarding climate through political participation and other activities connected to decision-making.

Another part of sampling strategy is represented by a geographic condition, in this study it is Czechia. The potential of researching the topic within this national context is the negative perception on the problematics by Czech respondents in terms of personal responsibility and seriousness of the effects of climate change in comparison to European average (European Commission, 2021, p. 1 - 2). In addition, since the researcher is Czech, choosing a Czech context represents a benefit in terms of familiarity with national context, culture, initiatives and proximity to participants.

Furthermore, another aspect of inclusion of the participants in the data collection process was a predisposition for them to already be in some way interested in the topic of climate change, hence be engaged in the learning process that is the subject of research of this study.

Deciding on sample size, the researcher had to take in consideration this project to be non-funded and time investment aligned with limited time frame for completion given the hand-in date for the thesis. As

a result, the sample size is idiographic, sufficiently small to be able to analyse participants' inputs individually and to mediate their identity (Robinson, 2014, p. 29).

A purposive sampling strategy as one of non-random methods has been selected to ensure participants fulfil the above-described criteria for inclusion in the research (Robinson, 2014, p. 32). Finally, the recruitment of the participants happened through researcher's social network account and a social media group through an announcement. After short written conversations with potential participants to decide whether inclusion criteria have been fulfilled, demographic information were collected prior interviews through interview guides (see **Appendix 1**); see **Table 2** for a list of participants with demographic information. For the purpose of confidentiality, some participants have chosen to keep their names and some have chosen other names or pseudonyms. A part of interview guide was also consent that represented an obligatory element before conduction of the interviews (see **Appendix 2**).

Table 2.

Presentation of Participants

No.	Interviewee	Gender	Age group	Education level
1	Residual	Male	25-30	Bachelor
2	Manos	Male	25-30	Bachelor
3	Tereza	Female	25-30	Master, *ongoing*: doctorate
4	Green	Male	40-49	Doctorate
5	Monika	Female	25-30	Master
6	Lucie	Female	25-30	Master
7	Cinnamon	Male	30-39	Master
8	Ondřej	Male	25-30	Master
9	Martin	Male	25-30	Master
10	XY	Female	25-30	Master, *ongoing*: doctorate

Ethical Considerations

The chosen ethical approach followed by this study is responsive ethics introduced by Amundsen and Msoroka (2021). Through participation in dialogues within the interview, a safe space that was interactive and respected individual differences has provided with results not only researcher but to participants as well through empowerment (Amundsen and Msoroka, 2021, p. 574 - 575).

Next, transparency of researcher was established so not to influence participants' answers but reflect researcher's personal values in agreement with responsive ethics (Amundsen and Msoroka, 2021, p. 571 - 572).

Another ethical aspect taken into account was domination in interviews aimed at avoidance of it; the interviewee was prompted to ask for reformulating asked questions, raise other questions or even reject to answer if he or she might not feel comfortable answering it; considering the aspect of dominance (Kvale, 2006, p. 489) was aimed at empowering the interviewee and setting the interviewer on an equal position within the conversation.

To increase the potential of the nature of qualitative interview and respect participants as individuals, an element employed within interviews were narratives since Brinkmann (2013) emphasised their importance in connection to the interviewing process (p. 60). Whenever possible, the interviewees were asked to connect their answers to a memory or experience or to simply tell a story.

As a result, a respectful environment that was honest and open to interviewee's remarks and questions was created; the participants were informed about the research and data handling. In order to ensure

confidentiality, the interviewees have chosen pseudonyms under which results were presented. Consent has been provided by the participants in both written and oral form giving the participant an opportunity to withdraw before the data collection itself. The study also aimed to create individual value for each participant, since it has helped to awaken one's thinking about internal as external processes including motivation and taking a critical perspective on aspects surrounding climate change.

Research Methods & Data Collection

The data collection instrument chosen for this study was a semi-structured interview to ensure the nature of research ethics is in agreement to provide freedom to participants in expressing their opinion and empower them to decrease the dominance of researcher's position (Kvale, 2006; Amundsen and Msoroka, 2021). The interview questions were prepared solemnly in relation to research questions. Before interviews were conducted, the collection tool was tested through a pilot interview and some questions had to be revisited before being able to finalize a complete set of interview questions (see **Appendix 3**).

In total eleven interviews were conducted that lasted between twenty and one hundred minutes. The interviews were held either in online or offline form and were recorded either via the Zoom platform using university login or through a mobile application recording voice messages integrated in the operational system of interviewer's phone.

The interviewer's intention was to introduce an atmosphere that is informal through conversation, which was not a challenging matter since the interviewer personally knew most of interviewees. Despite mostly following prepared questions during interviews, sometimes the interactions and questions must have been paraphrased or explained in a greater detail.

Some of the interviews took place online on the Zoom platform, whereas some were conducted in an offline space, a café. To compare these two experiences, offline-held interviews were shorter in duration with more focus and fast interactions, whereas online-held interviews tended to last longer, and participants have exercised signs of distractions at times and sometimes questions had to be repeated.

During data collection, participants have expressed interest in the topic and eagerness to share their opinions and views; when it came to graduate skills utilised for the learning process about climate change, many interactions had to be initiated to help participants address this question. Majority of interviews were conducted in Czech language whereas some in English, the choice depended on the choice of the participants to be able to talk about the phenomena in the language they comprehend them. Overall, a lot of English terminology was introduced within the interviews conducted in Czech as well to make sure language interpretations did not impact research quality.

Following the interview conduction, the interviews were transcribed manually and thereafter translated. Despite conducting eleven interviewers, only ten interviews were transcribed later due to absence of a consent form from one participant; despite given oral consent, the interviewee was not responsive as to give back a written feedback form as well as provide demographic information. The researcher has interpreted these facts as interviewee's withdrawal from the study and has not pursued further contact respecting interviewee's right to withdraw from the study at any point to respect research ethics.

Reflection on Research Quality

The fact participants are asked their opinions and personal experiences as well as since most participants were known by the researcher, it might be questionable whether these facts have influenced the data gathered during data collection. As a result of this, answers might have possibly been affected by participants' need to be reflected well in the research results. Nevertheless, this has been considered already from the very beginning of this research study. Firstly, through choosing a qualitative study and a tool that allows to reflect on questions in own words, in comparison to, e.g. surveys with a set of pre-

defined answers. Secondly, by embracing the participants' role and avoiding domination as an interviewer. Thirdly, through engagement of memories and experience getting real-life examples. And finally, by ensuring the participants there is no right or wrong answer. To conclude, despite there were identified certain risks in relation to research quality, the author has mitigated them through chosen methodology and ethical considerations.

In addition, since the language of interviews differed there might have been some impact in terms of terminology. Nevertheless, the key terms used were also mentioned in English

Data Analysis

Since the nature of the research is qualitative, the approach to analyse the data is in the beginning through coding Bryman implies is mostly known for this type of research (2012, p. 575). With the help of applying thematic analysis on the previously sorted codes, themes identified by Bryman (2012) were be considered:

1. Themes connected to the subject of my research, hence strongly associated with the research questions
2. Themes that are categorized
3. Themes further elaborating on codes

(p. 580).

To put the thematic approach within the context of my thesis, the data were studied from the viewpoint of research questions. First, all interviews were studied in detail and coded that represent the smallest units through labelling (Bryman, 2012, p. 568). Secondly, from codes themes with subthemes were identified and the previously coded conversations categorized. Thirdly, codes were analysed in regard to each participant, their frequency and their correlation and finally synthetized in the results section.

Results

The results section is divided based on the identified themes within the analysis that correspond research questions; subthemes correspond to interview questions. Within each subtheme the responses were grouped through found codes based on their frequency to present a concise demonstration of results. Through the chapter, direct quotations of participants occur that support the qualitative nature of the research as well as ethical considerations to empower interviewee's position and avoid a dominant presentation of results by the researcher as well as to show the communication amongst the researcher and interviewees during the data collection process; including quotations hence serves as an aspect providing an insight into the research itself that respect the individuality of participants.

Adult's understandings about climate change

Within the interview, participants were asked about their understanding about climate change in terms of its effects, impacts, whether they think climate change is human-induced and what are their perceptions on a group of people that denies anthropogenic cause of climate change.

Effect of climate change

In terms of what effects do the participants understand climate change has, the answers ranged were as follows order by the frequency of mention:

1. Rise of temperature and weather change
2. Air pollution, smog, and its effect on human's health
3. Sea-level rise and melting of icebergs
4. Ozone layer depletion
5. Food crisis, nutrition, humanitarian crisis, refugee crisis

Cinnamon also points out that climate change manifests iself unevenly and later elaborates on his view on the effects of climate change and positions humans to be responsible for the change:

> But it does not have to be like this and how Barack Obama said (he quotes): "We are the first generation to feel the effect of climate change and the last generation who can do something about it."

Who is impacted by climate change the most?

As to the group impacted the most by climate change, the answers might be grouped in five areas; some of the groups being thought about in isolation from the others, for example some participants have stated only one group but some related to the other groups as well.

Firstly, Manos mentions it is the planet it will affect the most alongside humans. Secondly, all the participants mention the impact on humans in connection to their health or wealth conditions. Cardinal is also according to the participants the country and location people live in; people living on islands where they are endangered by the rise of sea levels, their proximity to equator, developing countries and their possible lack of access to fresh water or being agriculturally unsustainable as well as those affected by Amazon rainforest deforestation.

Martin points out it is easier for him to emphasize more with humans. Furthermore, Tereza adds a gender perspective on the impact of climate change on humans:

> Probably it will be women based on, like what I have read recently, and it makes sense to me, they are more vulnerable towards these changes, like given a place in the society and typical daily activities and things like that so.. that will be bad.

Thirdly, the animal world was also mentioned by all participants with different degrees of urgency connected to the impact of climate change on this group. Most of the participants explained the effects of climate change that are connected to this group, such as ongoing loss of diversity as a direct result of human activity, for example deep sea fishing, hunting for sports or pollution. Some mention the role of insects, especially bees and state them as the most vulnerable group. In addition, Tereza mentions a local initiative in Brussels, where she lives, that has started building small islands of wild grass for the insects. Whereas Manos identifies humans to be in the same category as animals, Residual, on the contrary, denies climate change to currently have an impact on the animal world:

> Well, if you suddenly have in Europe, like, forty degrees and if you are like simulating let's say this middle-Easter climate, well definitely it is going to have the strong effect, but as far as I know, not really.

Next, the animal world was by some set apart from nature; Lucie claims plants to be the most impacted group whilst acknowledging the interconnection with other groups and thinks the impact is the biggest on the smallest going upwards through the food chain. Finally, some participants consider the impact global including all the previously mentioned groups. Whereas most stating this response refer to the impacted group as everyone and then sometimes specify who belongs to this inclusion, XY has chosen to refer to ecosystems:

> Ecosystems, because they are much older and bigger than humankind – I mean, by volume – them, of course, people that live in the ecosystems.

To conclude, the participants agreed the impacts of climate change are most severe on humans; nevertheless, some have also included animals and nature collectively in their perspectives.

Is climate change human-induced?

The answers to the question whether the cause of climate change is Anthropogenic or not differed amongst the participants with unclear views on the topic. Most of the participants used words such as *think*, *believe* or *maybe* to express uncertainty regarding their answer when acknowledging human impact on the climate.

XY's perception on the problematics brings in the need for evidence-based approach when thinking about climate change, stating that:

> (Climate change is induced) by people, or I think, that currently we do not have enough evidence to say it was not induced by people and at the same time we have a lot of evidence saying it is created by people

Similarly to XY, Martin believes evidence, in his case based on scientific news, and claims science is the only thing he can rely on. Tereza's opinion strongly resonates with the fact climate change is human induced coming from agriculture to heavy business to energy sector claiming human activity to be really invasive and hence influencing the world's climate immensely.

Although most of the participants avoided a direct answer, all of them correlate climate change to human activity and acknowledge the impact of humankind on it, stemming from their motivation and interest in climate change.

Climate change deniers

Perception of the participants on the group of those who deny climate change to be human-induced or happening at all varied in terms of trying to identify the causes for such thinking. Nevertheless, all the participants have exercised a respect towards the understanding and non-judgemental view on this group.

Residual, for example, claims:

> They (climate change deniers) have a right to deny. I do not judge upon those people, those people may think they are right.

In like fashion, Martin prompts to be considerate towards the opinions of others despite the fact they differ from ours and he disagrees with them and emphasises the fact that not everybody can know everything pointing out knowledge to be in the core of their denialism. XY, on the other hand, says she is frustrated by this group. Similarly to XY, Cinnamon connects negative emotions to this group's thinking and feels rather saddened that it is hard to convince someone about something they neglect despite providing sound arguments and sees the issue in the current media and disinformation.

In addition to the feelings towards climate change deniers, participants have reflected on their opinion connected to where this denial stems from. Most of the participants have mentioned lack of education influencing their perception of news, mostly those presented by scientific results as well as work with information and inability to recognize disinformation.

Monika emphasises the impact of education on personal and skills development and identifies the gap between the group of deniers and non-deniers to be the ability to self-reflect, be willing to work with information and think critically. According to Martin, the reason of climate change denial originates from denying science itself and connects it to the possibility to the lack of education. Green points out the communications gap between every day and scientific thinking and relates the issue to how news related to climate are presented to the public:

> Communication between scientists is completely different from the one that should be between science and the public, and at the moment when uninstructed and somehow completely uneducated journalists in the field are trying to make a bridge between them, it becomes completely wrong. So it is again about the attitude of the public to the fact they do not know how a scientist thinks. A scientist will say, it is a 90 per cent probability and that is just so significant that in the scientific world, everyone takes it as hard data, hard fact. This is just the truth. But when a layman hears that it is only 90 per cent, he will prefer to believe the 10 per cent – only because someone did not say it is the truth.

Furthermore, majority of participants mentioned a possible lack of responsibility related to denialism and inability to relate to future situations rooted in the fact climate change will not impact them. Monika stresses that people are not able to confess the humankind might be responsible for climate change. Another role in denying human impact of climate change might, according to some participants, stem from socio-economic factors, such as Tereza that sees the issues of the communication and misconceptions to be dependent on one's place in society:

> .. the way information are being served in a way that does not reflect daily realities of these people, because if you tell people in X (the name of the town was anonymized), the small town that I grew up, most of those people work manually or in manufactories and things like that, they are not rich, and if someone says that they have to give up their cars and their life that they are working hard for in order to support bigger, an invisible climate action, it does not work for them, so they get more aggressive and therefore are more open to disinformation I would say and still they also lack the basic understanding of it.

Cinnamon points out in his surroundings there is no need to confront deniers placing himself apart since he normally does not come across them normally. In addition, two participants are of an opinion that Czechia's ex-president, Václav Klaus might have influenced thinking of the nation in the direction leading to climate change denial. Cinnamon reminds that:

> .. when the president was Václav Klaus, he was known to not believe in climate change, he has even written a book about it called *Blue Planet,* not a green planet and talked about it quite a lot, so I understand there might be people that might say: "So, Mr. President, a university-educated professor of economics will probably know something about this, so if he says it, its is simply relevant to me" and it just seems terrible to me that one person can do so much damage in one country.

In addition to the previously mentioned reasons for denialism, some participants have also mentioned extremism within communication about environmental problematics to be a driver for denial as well as fear of degrowth with a result of losing human's superior status in the world.

To conclude, all participants exercise non-judgemental approach towards climate change deniers; nevertheless, some do so with some negative connotations tied to this group. The root cause of climate change denial majority considers to be education, whereas some participants find the general socio-economic factors to be the main influence in triggering climate change denial. Finally, some participants feel denialism to be represented by lack of responsibility, possibly amplified by the gap in communication of science news to public.

Motivation of adults to learn about climate change

The next theme regards motivation and its origins as a driver of the learning process about climate change. Associated to this theme are also disruptors to the ongoing motivation that present obstacles within the learning process of the participants.

Main emotional triggers

To begin with, all participants feel their motivation towards the learning process about climate change stems from their sense of responsibility. The ultimate reason for this responsibility lies, according to most participants, in the impact of humans on the climate change.

At the same time, feeling endangered as a human kind, a threat posed by climate change represents a driver according to some participants as well. XY labels this threat as "an instinct of self-preservation" while Ondřej elaborates on his sense of responsibility and backtracks it to human kind:

> Every change leads to some consequences that we are not able to predict and thus has a great impact on humans.

Most participants have acknowledged that despite the fact their generation will probably not be severely impacted, it is towards the future generations they feel the most responsible. In addition, Manos underscores Planet Earth not to be under human ownership. Similarly to Manos, Lucie reminds the importance of Planet Earth and the fact we should take care of it.

Moreover, some participants associate their motivation to the fact it is a very current topic and they are interested in current affairs. Furthermore, Ondřej and Green consider their motivation to stem from their personality and regard it as natural.

In short, motivation stems for the participants from responsibility for all and for some from fear that it represents to humankind as well as guilt that is associated to human's impact on climate change.

Exploring biographical factors: context leading to initial interest

Following the discussion of motivation in connection to learning process about climate change, the participants were prompted to recall a memory connected to when their interest in the topic was sparked. The answers to the question varied; interestingly, while some have chosen to associate the time their interested started with the year at school, none of the participants have stated school to influence them

while developing curiosity with the topic. Most of the participants have been influenced by someone; mostly through their family or close friends. Tereza and Cinnamon associate their interest to begin with their participating in Scouts that helped develop a positive relationship with nature and to the environment. In addition, Tereza claims that initiatives taken by Brussels, where she currently lives, played a role in developing responsibility and motivation for her as well making her feel more responsible and enforcing values connected to sustainable behaviour as well. In like fashion, Manos, that comes from Greece, mentions recycling initiatives in the country to be a trigger for him to try to understand why they were undertaken. Another initiators for most of the participants were media. Ondřej recalls this moment:

> I still remember that it made a big impression on me, when there were ads on TV like "it makes sense, sort and recycle waste".

For Martin and XY, their interest in climate change originates from their previous interest. In Martin's case it was technology; in the case of XY, in search for ideal diet that has helped her find aspects connected to the impacts of it on the environment and sustainability.

In conclusion, the context that initiated participants' interest in the topic of climate change differ with the majority claiming the social element to be the most important aspect.

Disruptors of motivation

In another part of the interview the participants were asked whether their interest might be in some way disrupted. The answers might be divided into three groups with all participants feeling a certain powerlessness in that regard connected to oneself, other people and official communication of the problematics.

Firstly, some participants time to time feel they personally cannot contribute to the improvement of the situation. Martin, for example, admits this feeling and associates it to a sort of nihilism but at the same time acknowledges responsibility he feels towards others. Secondly, most of the participants find the biggest disruption lies in other people or society as a whole. Ondřej claims the biggest disruptor of motivation is when people argument they are not able to save the Planet on an individual level and emphasises "the whole starts with the individual". In like fashion, XY reflects her view on how her own motivation gets disrupted by other people:

> Unfortunately the mentality of a large part of the population, who either completely ignore or categorically deny this question and it is only because they want to deny it without thinking about it.

Cinnamon implies the current society's standards influence thinking about the problematics he is not in agreement with, such as capitalism that undermines the idea of self-delimitation. Thirdly, some participants, such as Monika, feel frustration by the attitude of the local government and the whole Czech society and as a result feels isolated with a widening gap between her and others. In addition, XY points out struggles in connection to communication of issues related to climate change that negatively impact her learning process about climate change, such as unclear distribution of competences in the climate change problematics, lack of set limits and other obstructions in terms of competences that are negatively impacting the possibility to act against climate change.

To summarize, motivation is disrupted for most participants by behaviour of society; for some especially within the national and official context.

Ways adults learn about climate change

Another theme recognized within the research relates to ways adults learn about climate change in connection to how and in what learning spaces they gain knowledge and how they assess accessibility, reliability and clearness of information as well as whether they find some issues with current media that might possibly disrupt and corrupt their learning process about climate change.

Learning spaces

There are different learning spaces that participants have identified their learning process about climate change takes place; it ranges from mass media to scientific reports with most of them combining two or more options listed below:

- Scientific articles and official reports
- Mass media
- Popular scientific articles
- Own research
- Documentaries
- Interactions including social media.

To begin with, scientific articles as resources for learning about climate change are used only by two participants, some have expressed the complexity of the topic and vocabulary represent an obstacle for them. Official reports are used by XY that highlights the importance of familiarity with the resources since she has been working for organizations such as European Union or United Nations.

Most of the participants utilise mass media to familiarise themselves with both news and topics regarding climate change. Nevertheless, majority stated to be selective about learning resources. Ondřej, for example, uses Google to prompt him articles that might be of interest for him through his preselected topics. Cinnamon chooses concrete resources in different languages, such as The Economist in English, Respekt in Czech and El Pais in Spanish. On the contrary, Residual does not regard news as a good source of information:

> The official news, mainstream media, I am not fan of it, because I can see the pattern how they are talking the same and usually it is nonsense.

Most of the participants prefer articles that are easier, for general public or popular scientific articles. The best they feel are those that summarise the topic. In addition, some participants choose to make their own research on topics they are interested in to learn more, such as Martin that likes learning about technology. Another resources are for some participants documentaries on TV or watched on streaming platforms. Lucie, for example, prefers to watch programs on television on National Geographic or Prima ZOOM.

All the participants learn in some way through social interactions in different forms. Firstly, some choose to follow contributors through social media. XY regards social media as a possible replacement of traditional mass media:

> .. and then as social media began to gain more and more visibility, I started to consume it more, because I think that if you find some well-processed and verifiable sources that it can replace the mass media quite well.

Similarly to XY, Monika finds social media to be very important and also claims to choose her own resources that she follows and finds reliable. Furthermore, Green, that is a climatologist, follows his colleagues or experts in the domain on social media to learn about new developments. Tereza points out her interest in fashion and the fact she uses social media to follow accounts with this education purpose.

When talking about whether participants learn from traditional interactions, three groups of answers have emerged. Firstly, interactions with family as their way to learn about climate change are only regarded by three participants, two of them influenced by their younger sibling; for Martin it is his sister that he associates with the generation of Greta Thunberg, a well-known environmental activist[1]:

> My sister, she is really interested, not because she studies it, just generally interested, because she thinks it is important – generation Greta I guess, so.. these things are sparking her, so the things she brings up are interesting.

Next, XY has conversations with her mother that shares her diet and claims they talk about current news including environmental view on different problematics. Conversely, some participants have rejected to open the topic with the family, such as Lucie that prefers to not discuss the topic at all since fights stem from this situation. Another participants have, in comparison to Lucie, a rather neutral relationship about the topic claiming their conversations have to be bound to bigger news or completely random. Tereza implied topic of climate change to be a part of everyday conversations. Most of the participants are having conversations with their friend in like fashion as well and consider friends to interact with about the topic significantly. XY explains why the topic has been so present in the conversations with her friends:

> I also think that over time it has also become a topic that you and your friends usually discuss over a beer, because it is so urgent and ubiquitous that it is slowly becoming a part of everyday conversations – it is not something that we would say "Now we are going to debate climate change"; no, rather someone will read something somewhere and I also think it has also something to do with the omnipresence of social media, you read something, then you bring it up and talk about it, so in the end it is a natural part of a conversation nowadays.

In addition, work environment plays role for some as well, for Cinnamon it is his company and its educational initiatives where he has possibilities to go for a lecture or workshop. Tereza, that lives in Brussels, finds her colleagues, that work in sustainability projects, to be the main source of information.

The participants in the study identified various learning spaces they utilise for learning about climate change, including scientific articles, official reports, mass media, popular scientific articles, own research, documentaries and interactions including social media. While some participants found scientific articles and official reports useful, other found them complex and difficult to understand. Mass media was a commonly used resource, with participants being selective about the chosen resources. Popular scientific articles summarizing the topic were preferred by many. Some participants conduct their own research on topics they are interested in. Above all, significant role play social interactions with participants engaging in conversations with friends and colleagues.

Perceptions on climate change information

In relation to the ways participants learn about climate change, they were asked about whether they find the presented information accessible, clear and reliable as well as whether they feel there is an issue with media and if yes, what the problem is.

To start with, most of the participants think information about climate change are easily accessible since it is a topic that is current. Nevertheless, XY emphasises official documents and reports might not be as easily accessible to everyone than other resources:

> Social media yes, those channels but the official information issued by, for example, European Commission, I think are accessible much worse even though you can google it

[1] A Swedish environmental activist known for her movement "School Strike for Climate" and public speaking as well as challenging world leaders (Britannica, n.d.)

> quite easily, but since most people have no idea what kind of hierarchy and operations these institutions have, it is very difficult to search for them also to know where to look; on top of that, when they do find them they do not quite understand why the information coming from this institution is so relevant so I think that they are hard to find, even if they are traceable.

In agreement with XY's claim is Martin's answer regarding clearness of official reports and his choice to avoid official reports stems from lack of clarity and visualization in official reports or reports papers. Nevertheless, most participants find resources through which they learn about climate change clear, such as Cinnamon that refers to the fact his selection of resources to be of a good quality, comprehensible and accessible. As a result, Cinnamon's choice of resources are at the same time reliable for him since he filtered and preselected them.

Monika emphasises her utilisation of skills in relation to reliability of media, such as work with information. Similarly to Monika, Ondřej relies on his skills to evaluate the reliability of information.

In like fashion, most participants have drawn their view on media and claim them to be unreliable representing the biggest issue of media nowadays. This unreliability manifests according to them mostly in disinformation and simplification of information. Ondřej sees the root of the issue in one-sidedness of transmitted information. Anagolous to Ondřej, Martin is aware of this issue and connects it to the issue of unreliability and claims where interest is involved he knows he should not rely on the source. Furthermore, two participants recognize to have a time issue when looking for information since their research is only limited as well as their time options they are able to invest.

In conclusion, despite participants consider information on climate change they consume reliable, they emphasize the need to be selective about their resources.

Graduate skills, their usage and role during the learning process about climate change

Within this part of interview participants' skills acquired during university studies were studied from the perspective of their application to the learning process about climate change and also their impact on participants' confidence to further learn about the topic.

Most of the participants feel university studies have been beneficial and provided them with skills they utilise in their learning process about climate change. Monika stresses the importance of university environment in relation to skills development, such as critical thinking, later found to be cardinal for their learning process about climate change.

Tereza, on the other hand, at first rejects university to play a role in her learning process about climate change but later admits a possibility of developing it during her studies. She later elaborates and claims some skills interviewer mentions are "not really something you learn at law school" pointing out the focus on content together with another two participants that were students of law school themselves. Ondřej claims the disadvantage of his studies to be:

> The fact that I had to cram even things that were not important and useless and despite this fact required by the teachers; I thought it was completely pointless.

Nevertheless, in spite of focus on theory, XY found some discipline-related skills taught at law school to be beneficial during her learning process about climate change, such as orientation in the hierarchies of international organizations and institutions as well as the role of the state that currently helps her identify the level of commitment of each institution in the climate change issues.

In addition to this skill, all three participants that studied law mention a subject on environmental law that has covered partially environmental protection from the law perspective; another discipline-specific knowledge was mentioned by two participants that studied electronic engineering, specifically

automation and knowledge about nuclear power. Furthermore, Lucie studied biology at the bachelor and environmental geology at master level and claims the studies have knowledge-wise supported her learning process significantly:

> When someone brings up a topic I am able to comment on it from a professional point of view and these are not my assumptions but what I have learned and that it is scientifically based.

Cinnamon that studied English, claims his language skills to impact his learning since it provides him with a greater variety of sources and being in less need to be selective about his resources. Skill mentioned by most participants was work with text and to it associated analytical skills. From a basic analysis to research and methodology, understanding of other academic texts and utilisation of critical thinking whilst analysing text were among activities developed during university studies within this particular skill mentioned the most. Monika emphasises studies to be beneficial for her not only to understand how to work with information, but to recognize a disinformation. Ondřej claims he is able to process a bigger amount of information as a result of his studies and utilises this skill when learning:

> I am capable to hold a much larger volume of information, because law is a lot about reading and you have to remember a lot, and thus when you remember a lot of things, for example, I know that I read an article six months ago and there was something I can compare to with what I read today.

Cinnamon highlights his skills in connection to work with text have been improved during his studies, mostly in relation to the need to search for information. In this regard, Lucie reminds accessibility of resources to be an advantage for university students. Most participants intertwine work with text with critical thinking, such as XY:

> It is a lot about work with the text and resources that I consider to be the most important knowledge; such as how to approach the text, how to distinguish between what is rather a primary source, verified information or original information and also whether what I read is a paraphrase, interpretation or a complete misinterpretation.

Ondřej adds:

> Everything you learn in law school, you learn to subject more to critical thinking, that you subject everything that is written in multiple forms of interpretation; that what you read at first does not necessarily mean what you understand when you first read it, so you try to somehow interpret it into the system and article in which it is written.

Another skill mentioned brought up was problem-solving, most participants have not felt studies were beneficial in development of this skill; XY and Residual claim their problem-solving skill was rather developed during their work. Nevertheless, Martin that studied business management, opposes with his experience from university that has supported development of this skill. Next, ethics has been identified by Cinnamon as a natural result of studying humanities that has shaped his perception on world. Nevertheless, Tereza associates sense of ethics more to work than to her studies.

Some participants have mentioned communication and interpersonal skills, such as team work and leadership as skills acquired at university used for further communicating a new knowledge gained in the area of climate change. XY underscores the role of university environment and social relations gained through university studies:

> I think that the social element also works there, there are a lot of people with the same or similar opinion orientation, or even completely different opinions but that you have an environment thanks to which you can develop those skills thanks to the fact that you are

> surrounded by these people.. then there is also peer pressure, I would say that the social element is just as important as the skills you acquire.

Moreover, Cinnamon mentioned systems-thinking and overall developed thinking about society as a result of his studies. For Ondřej also a self-discipline and self-motivation that he reflects directly into his learning process.

Whether the skills has made participants more confident as learners was by some participants answered positively. Nevertheless, Martin claims his confidence to be influenced by his knowledge of not being knowledgeable in all subjects:

> It probably makes me less confident, because I know there is many things that I do not know but I am also more confident in a way that I, at least know, that what I know and I am certain of it.

To sum up, all participants feel their university studies have provided them with skills or to their development that they currently use for the learning process about climate change. The most utilised and useful is for most participants work with text and associated analytical and critical thinking skills that directly influence their choice of learning space and work with information. Other skills, such as system-thinking or language skills were mentioned as helpful components in learning process about climate change. Nevertheless, answers to whether problem-solving and sense of ethics have been developed during university studies were ambiguous and according to some rather developed within work than university environment.

Discussion and Recommendations

Within the discussion chapter, findings of the study in relation to research questions will be presented. Next, they will be interpreted in line with literature review and Illeris' understanding of *adult learning* and the study results will also be regarded through the epistemological lens of his three-dimensional model of learning development.

RQ 1. What are adult's understandings about climate change?

The way participants understand climate change have differed in relation to its effects, impacts and anthropogenic origin on an individual level. Firstly, they identified the effects of climate change as ranging from rise of temperature and air pollution to sea-level rise, ozone layer depletion, and even effects on humankind, such as food crisis. Secondly, participants agreed the impacts of climate change are most severe on humans; nevertheless, some have also included animals and nature collectively in their perspectives. Thirdly, while participants have avoided to state directly they believe climate change is human-induced, all of them correlate human activity to the acceleration of its effects. Finally, as to what the perception of the participants on climate change deniers is, all the participants have taken a non-judgemental view in terms of opinion differing from their own. The majority of participants mentioned a possible lack of responsibility related to denialism and inability to relate to future situations rooted in the fact climate change will not impact them. Some participants also consider the communications gap with public in climate change information as well as insufficient trust in science to be present among deniers. Furthermore, most participants believe education to be a root cause of climate change denial and some connect it to socio-economic factors as well.

With respect to literature review, study by Leiserowitz (2021) confirms participants' perception on climate change that believes in the fact climate change is human-induced to be in agreement with the description of the first, alarmed group that is highly motivated and hence represents a hopeful group to be led to different forms of activism (p. 101). Next, in line with study by Colombo et al. (2023) participants' have exercised nonjudging behaviour that the authors connect to the ability to prevent negative emotions connected to threat posed by climate change (p. 9). Such behaviour might become an inspiration to others and lead to pro-environmental behaviour.

RQ 2. What motivates adults to learn about climate change?

Through the means of the second research question, motivation in relation to the learning process about climate change was addressed. Since motivation was a key component within this research that has influenced study sampling, it was present in conversations with all participants. Motivation stems for the participants from different feelings, for all from responsibility, for some from fear or guilt. Many were influenced and had their interest sparked by their friends and family members or media. Some have also associated participation in Scouts, local initiatives, or previous interest area to be the initiators for thinking about climate change.

Whitmarsh (2008) proved people feeling risk in connection to the effects of climate change exercise pro-environmental behaviour that were reflected in this study by participants' feeling of responsibility toward humankind and hence represent a form of pro-environmental behaviour. Billing (2007) and Martínez-Roget et al. (2020) have identified motivation to influence acquisition of skills, academic performance and several other authors (de Haan, 2006; Gifford and Comeau, 2011; Mohamad et al.,

2023) believe its impacts development of *sustainability competencies.* Therefore, motivation represents a cornerstone for learning as a whole as well as learning about climate change.

As a result, it is important to highlight the role that individuals can play in addressing climate change but at the same time acknowledge emotional impact of climate change on them. Feeling responsible, guilty or scared by events surrounding climate change creates a negative connotation around the topic. By promoting conversations and actionable steps to take, climate change effects might be mitigated and society more encouraged and open to take action towards sustainable future. Nevertheless, there is also a need to mention external influences, such as conversations with others, to play a role in addressing those feelings and that has possibly turned them into a motivational rather than sacrificial framing (Gifford and Comeau, 2011).

Within the process, an area exceeding research interest has been revealed concerning how participant's motivation is disrupted. Most participants feel disrupted by behaviour of society; some by insufficient communication about the matter and governments.

RQ 3. What are the ways through which adults learn about climate change?

The third research question inspects ways through which adults learn about climate change. Non-formal ways through which adults learn about climate change vary from official reports, scientific articles, popular scientific articles through mass media to documentaries as well as social media and interactions with others. The selection of resources relevant for each participant are decided based on their knowledge and their skills that play a cardinal role within their learning process; for some, it is also a matter of personal preference and interest that decides their selection of learning spaces. Information consumed is generally to be regarded on as easily accessible but very often manipulated with an increased need of skills leading to selection of reliable resources. In connection to the lack of expertise and skills in scientific topics and terminology, most participants avoid informing themselves through official or scientific reports. All participants learn through different, but at least one kind of social interactions, such as social media, interactions with families, friends or colleagues and emphasize the topic has become part of everyday conversations.

The study's findings support Stetka's (2022) report on a low score of media reliability in the Czech context reflected by participants' need to be selective about their resources. With this in mind, it is suggested to address problems of unreliable media, for example by establishing an official initiative in a national context to communicate information about climate change to promote awareness and provide accurate information across different audiences, for example on a basis of the study by Leiserowitz et al. (2021), with the help of scientists and experts on communication with public in a Czech context.

Above all, the research has revealed a high engagement of social element within learning process about climate change, for example through friends, and for many conversations and inspiration from others sparked their interest and motivated them to pursue their learning about climate change. Nelson et al. (2022) and Pöllänen et al. (2023) confirm social influences play an important role in achieving sustainable society. Therefore, it is recommended that educators and policy makers should promote and facilitate more opportunities for society to engage in conversations within their own environment, such as universities or broader community on the topic of climate change. In addition, it is crucial the social element of learning about climate change to be extended beyond formal education for adults to feel more empowered to act.

RQ 4. To what extent, if at all, do adults use graduate skills during their learning process about climate change? Do the graduate skills have a role within the learning process about climate change and if so, what is the role?

The fourth research question aimed to investigate whether or not graduate skills are used during participants' learning process about climate change as well as their role on the process. Most participants have found graduate skills to be beneficial in their learning processes about climate change and those who initially thought otherwise, have in the end acknowledged presence of some of those skills and their development during university studies. As for their role, they are used within learning spaces and decide on the selection of resources used within the learning process.

Some participants have found elements they apply during their learning process about climate change taught within their discipline, such as environmental law or nuclear power. One participant marked language skills to impact his learning and therefore broaden his possible learning content about climate change. Most participants have acknowledged to acquire analytical skills and critical thinking in connection to work with text during their university studies that they actively utilise within their learning process about climate change. The next skill identified by some participants was problem-solving that was not so prominent next to the previously mentioned critical thinking and analytical skills. Furthermore, some participants associate this skill rather to work environment. Some participants consider communication and interpersonal skills acquired at university that they further use in their learning process about climate change. Ethics and behavioural changes connected to university studies were mentioned by one participant as a natural result of studying humanities.

Most of the above mentioned skills were identified and included within the list of key competencies by Wiek (2011); namely analytical and critical thinking, action-oriented competency, values thinking and interpersonal skills. Above all, inter- and intrapersonal skills play a cardinal role in adults' development of skills and achieving their full potential, with interpersonal skills initiated through communication with others, such as with family, by being a part of Scout or engaging in conversations that later develop into intrapersonal competence that are exercised through their reflections, motivations, sense of responsibility, empathy, and personal limits of capacity being in agreement with suggested emerging intrapersonal competence (Redman and Wiek, 2021, p. 6). In addition to sustainability competencies, some skills and overall descriptions of participants' learning experiences are in agreement with the definitions of climate literacy that represents an ability to assess whether information about climate are credible or not (Dupigny-Giroux, 2010; Liu et al., 2014).

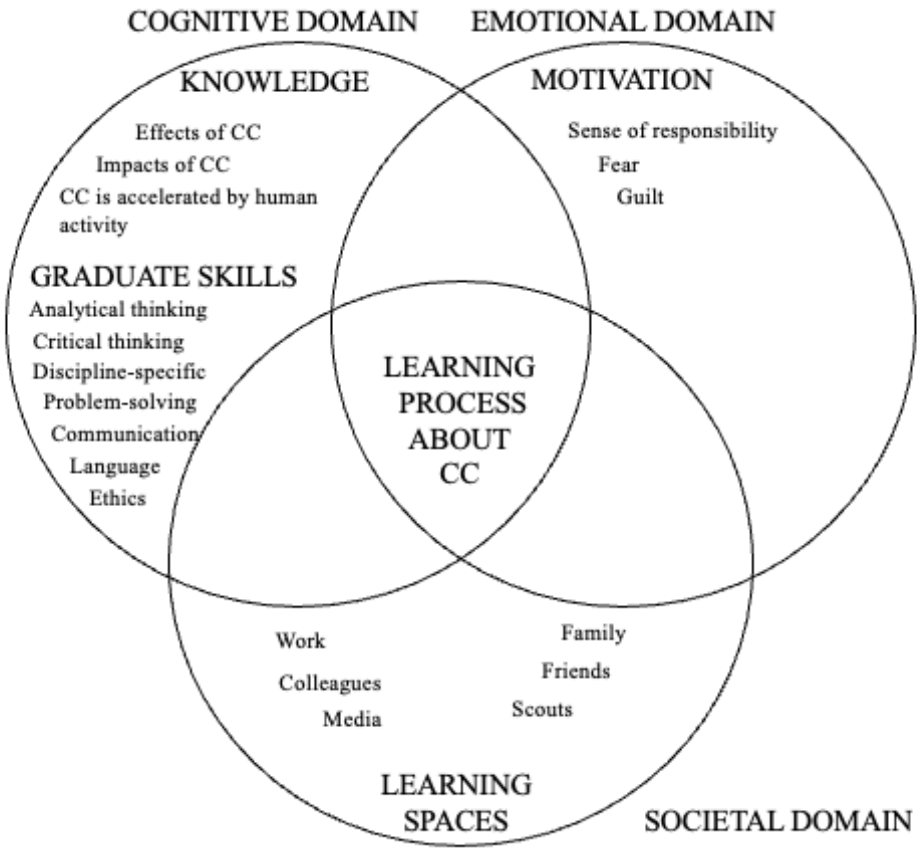
Overall, since all participants' have been influenced by the university environment, are these findings in agreement with Nelson et al. (2022) that has proven community plays role on one's development of pro-environmental behaviour including their interest in the topic (p. 1). Another study in unison with presented results is study by Leiserowitz (2021) that confirms correlation of university studies and motivation to be engaged in activities, in the case of this study learning process, related to climate change (p. 98).

Dimensions of Adult Learning about Climate Change

In applying the three-dimensional model of learning to the discussion of the study on graduate skills and their use in learning about climate change, we can see how the model helps to provide a framework for understanding the complexity of the learning process since all domains were addressed within the study results. To start with, the left corner of **Figure 4** represents the cognitive domain through knowledge and skills that is particularly relevant since it concerns the content of the learning process and the construction of meanings as well as abilities to enable individuals to function in different situations. Knowledge, that is prior and represents an element within the learning process about climate change, has been described in RQ1 drawing on people's perception about climate change through its effects, impacts, and origin of climate change.

Figure 4.

Dimensions of Adult Learning about Climate Change



Note. Adapted based on the three-dimensional model of learning from Illeris (2017, p. 25). Copyright by Routledge.

Nevertheless, cognitive domain also includes skills acquired during university studies, hence graduate skills that have been addressed in RQ4. Motivation of participants is expressed through the emotional domain studied through RQ2 and it comes from different feelings. Above all, the research has uncovered a crucial role of social relationships in shaping one's motivation to learn about climate change, this leads to uncovering a third domain, the societal domain that is represented by RQ3 and associated learning spaces as to as how their learning takes space currently as well as in the context of RQ2 exploring influences that sparked interest in climate change.

In addition, there are certain interactions between domains through internal and external processes. To start with, for some participants an impulse to engage their emotional domain, for example to spark interest and motivation to learn about the topic, was through societal domain drawing on the impulse coming from the external to an internal process. Next, an internal process is simultaneously triggered by one's acquired set of graduate skills and motivation to learn about the topic. The interconnection of the three domains through engagement of both internal and external processes initiates a whole learning process about climate change in **Figure 4**.

Furthermore, since participants engage in non-formal education in different forms that is initiated by them, this corresponds to Illeris' (2017) definition of adult learning to be a voluntary process (p. 3). In addition, some participants recall their studies were bound to theory and doubted the benefits of their studies within their learning process about climate change. This represents a traditional approach of the

cumulative and assimilative forms of learning and confirms Illeris' (2017) claim that sees it as unfit to today's everchanging world (p. 38).

In relation to holistic learning, two different results of learning might be observed. Firstly, competence that was already discussed within the previous chapter of the discussion and hence proves engagement of the three dimensions to result in competence development. Secondly, identity change, since it also stands at the intersection of internal and external processes of learning, it might also be argued, to be a result of learning.

Future Research

To start with, future research might address this study's limitations in terms of sample size and geographical location; conducting research in different contexts and with larger sample size might lead to a more comprehensive understanding of the issue.

Researching adult education about climate change in relation to skills might help to comprehend the role of diverse educational resources in non-formal settings during the process of learning. This research could also aid better understanding of division of different resources in terms of skills within non-formal education. For example, whether some resources such as podcasts or workshops promote the development of critical thinking or problem-solving skills.

Furthermore, by addressing recommendations outlined in this study, such as incorporating conversations about emotional impacts of climate change, it would be beneficial to examine their influence on empowerment and behaviour of individuals.

In addition, report on media pluralism in the Czech Republic connected to news about climate change would bring a clearer view on transparency of Czech media. Consequently, whether the current level of local media plurality affects adult climate change education negatively if any biases or conflicts of interests were uncovered. Another recommendation for future research is to map audience, similar to Leiserowitz et al. (2021) to find out how to best communicate information about climate change to adult audiences and what are their characteristics.

Next, in connection to skills acquired through higher education research focused on skills and how they transform through higher education in comparison with pre-tertiary-education would help better differentiate the level of mastery of skills acquired during these education stages as was also suggested by James et al. (2013, p. 959). Furthermore, future research might conduct an ethnographic observation studying in which environment, whether school, home, or work, are graduate skills developed the most during higher education studies.

In addition, despite my study has provided insights into graduate skills in the context of learning about CC, further studies might focus onto how universities already support development of sustainability competencies through the implementation of the qualification framework compatible with the European Qualification Systems (Eurydice, 2023).

Following Martínez-Roget et al. (2020), an angle studying influence of personality traits, such as curiosity, with respect to motivation to learn about climate change, might represent another contribution and possibly extend Illeris' learning theory or study the connection between curiosity and motivation, whether curiosity itself is able to trigger the motivation process to initiate learning.

Finally, a more comprehensive study that elaborates more on motivation disruptors to learn about climate change might identify reasons behind the disruptions and identify strategies to address it.

Limitations

There are several limitations within this study to acknowledge. Firstly, the time frame has influenced a lot of decisions in methodology, such as sample size, since it was limited to be able to hand-in for a planned date. Secondly, resources were limited as well as this is non-funded research; hence there were impacts on the chosen methodology. Thirdly, some aspects might have been discovered in more depth or in comparative aspects, mostly in terms of intersection of climate literacy, sustainability competencies and graduate skills. Fourthly, the study might have been more focused on specific disciplines of graduates, such as law, to gain a better view on their skillsets within certain disciplines. Fifthly, using a different or additional data collection tool, for example through focus groups or case study, to either replace or triangulate the data might have provide more fruitful results. In addition to this limitation, a mixed-methods study through questionnaires to provide a representative sample in a combination with a qualitative tool for data analysis for interviews to bring personal aspects might have resulted in more promising outcomes as well. Finally, certain limitations were found when applying theoretical framework in terms of temporal context, mostly defining prior knowledge and initiation of motivational process in past experience.

Conclusions

This study aimed to explore adults' understandings about climate change, their motivations to learn about it as well as the role of graduate skills in their learning process. Ultimately, the research has confirmed some graduate skills, such as analytical and critical thinking, to play a significant role within graduates' learning process about climate change. Furthermore, these skills influence the way graduates select and work within learning spaces as well as judge their reliability. Most selected resources are represented by popular scientific articles that fill in the communication gaps of scientific findings offered to public. Unfortunately, the need for selection of resources might lead to disruption of the learning process that reflects the current issue of Czech media.

Furthermore, the topic of climate change has become part of everyday conversations and the main motivational trigger is evoked by sense of responsibility but also fear or guilt towards events connected to the disruption of climate. Despite feeling accountable themselves participants did not judge people denying anthropogenic origin of climate change but at the same time feel their motivation to learn to be disrupted by this group. Participants precepted climate change to be accelerated by humans, acknowledged different effects of climate change and felt its impacts are most severe on humans.

Overall, the studied group of graduates that are motivated to learn about climate change have exercised several elements of pro-environmental behaviour. Firstly, through their nonjudging behaviour; secondly, by feeling responsible as a result of feeling in risk and thirdly by being influenced by communities. Accordingly, the study highlights the importance of education and potential of graduates to take action to address climate change since educational institutions provide opportunities to learn and represent an ideal space to foster a culture encouraging pro-environmental behaviour.

Above all, the research has revealed a high engagement of social element within learning process about climate change, for example through friends, and for many conversations and inspiration from others sparked their interest and motivated them to pursue their learning about climate change.

The interconnection of graduate skills with motivation and strong social element has proven Illeris' three-dimensional theory of learning development to be in agreement with a holistic approach for learning and hence represents an effective theoretical framework in relation to adult learning about climate change. Therefore, it is important to not only consider cognitive abilities but the whole individual when designing educational training on climate change for adults that focuses on all three dimensions of Illeris' triangle of learning. By doing so, the programs and activities might lead to better outcomes and be more effective in promoting pro-environmental behaviour and empowerment of individuals.

This research has a potential to inform education and environmental policy by identification of factors influencing skills and motivation of adults with higher education degrees to learn about climate change. Through this information, more effective strategies might be developed to engage this group in climate change education and encourage them to take action to address climate change. Furthermore, my research assists the broader goal of lifelong learning promotion by exploring the factors influencing adult learning.

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Appendices

Appendix 1: Interview Guide

Hello!
Thank you for agreeing with participating on my research for my master thesis project. My research for this project focuses on the process of learning of climate change by those interested in it. Firstly, my objective is to learn about your motivation to learn about climate change. Secondly, to discover what skills that you acquired during your high school education are utilised, if at all, during your learning process about climate change.
Looking forward to our interview. Now, please, have a look at the instructions below.

Instructions

1. Fill in demographic information.
2. Carefully read chapters about the research, ethical considerations and consent.
3. Confirm consent.
4. Send the filled in interview guide back to my email address: gusmulji@student.gu.se.

Demographic information

*When list of options is offered, **highlight, or fill in the correct answer in bold**. As for a personal identifier you can select a pseudonym of your own choice, e.g. Batman.*

Personal identifier	
Gender	Male / Female / Other
Age group	18-25 / 25-30 / 30-39 / 40-49 / 50-59 / 60 or older
Marital status	Single / married / divorced / separated / widowed / in registered partnership
How many children are you parent or guardian to	
Native language(s)	
Country of origin	
Country of residence	
Education level (finished)	(bachelor) degree / second (master's) degree / third (doctorate) degree
Education level (ongoing)	second (master's) degree / third (doctorate) degree / none
Subject matter studied (e.g. law, computer science, arts)	
In case it is needed, I agree to a follow-up interview.	Yes/No
Do you wish the results of the study to be sent to the email address or some other way of communication?	Yes/No Way of communication: e-mail / other: specify

About the research

In case you want to verify the fact this research is being held under University of Gothenburg, contact my supervisor (contact in the table).

Name of the researcher	Jitka Charbonnier
Contact information	gusmulji@student.gu.se
Contact of the supervisor	Adrianna Nizinska; adrianna.nizinska@gu.se
Title of the study	**Skills and Motivation of Adults with Higher Education Degree for Engaging in and Learning about Climate Change**
Purpose of the research / Research Goals	1. To uncover what motivates adults to learn about climate change. 2. To understand how do adults that are interested in climate change learn about climate change. 3. To find what skills, to what extent or if at all are graduate skills used during their learning process about climate change and to uncover to what extent does having those skills influence their learning process about climate change.
Information about the research	Exploratory study
Methodology of the research	Qualitative Convenient and snowball sampling
Data Collection Instrument	Semi-structured interviews

Ethical considerations

- ⇒ Voluntary participation: research subjects participate in the research on voluntary basis.
- ⇒ Informed consent: research subjects are informed prior interviews about the research, its goals and data handling and provide a consent prior as well as in the beginning of interviews.
- ⇒ Anonymity: research subjects have a personal identifier associated so their identities are anonymous.
- ⇒ Confidentiality: all information is treated with the highest level of confidentiality.
- ⇒ Potential for harm: no types of harm to the right, welfare or safety to the participant are expected.
- ⇒ Results communication: research subjects have the opportunity to receive study results via their selected way of communication.
- ⇒ Data handling: Audio recorded via ZOOM (university license) and stored on researcher's laptop or via integrated mobile phone application on iOS; interview manually transcribed and stored on OneDrive associated to university account; data analysis through licensed software NVivo; data will be accessed by researcher and supervisors; thesis published publicly; after research is conducted recordings of interviews will be deleted from researcher's laptop

Appendix 2: Consent Form

I have read all information provided by the researcher. The research was satisfactorily explained by the researcher to me in written (and/or) in oral form. I understand the research will be conducted online through a ZOOM platform or in a location selected by researcher and participant on a previously agreed time with the researcher through an interview. By taking part in the interview, I am giving consent to the researcher to use the information provided for the purposes of research. In addition, I am aware of the way the data will be handled with and stored. I also understand my right to withdraw from this study at any point without the need of further explanation. Any material of me will be used solely for research purposes and will be deleted when the research is completed.
The consent to participate in this research study was given freely.

☐ **I consent.**

To consent double-click on the checkbox and select "Ticked".

Appendix 3: Interview Questions

No	Question
1	Why are you interested in climate change? Why do you find it important? When and how did you interest start?
2	How do you learn about climate change? *Through which channels / online, offline / books, magazines, news, social media, online articles?* Do you also learn through exchange of opinions and interactions with other people (experts and peers)?
3	What kind of information are you searching for when learning about climate change? Is the information you find easily accessible and clear; reliable?
4	Give me a very short description of what you studied, what subjects you had and what required to complete both the subjects and the studies. What skills do you feel like you engaged?
5	Do you think you use some of the skills (both hard and soft) you acquired during your university studies during the learning process about climate change? Would you say that in your case, a university degree makes a difference in a way you learn about climate change? How and why?
6	If yes, to what extent do you feel you use them when learning about climate change? Do you find these skills are in favour learning about climate change?
7	Does having those skills make you more confident as a learner in this area?
8	Is there something you find difficult or are there any obstacles when it comes to climate change, maybe something that demotivates you?
9	What do you think is a cause of climate change?
10	Why do you think some people deny climate? Why do you think they do not believe in climate change?
11	What do you think are the effects of climate change? What does climate change impact? How does climate change affect the world?
12	Who do you think is impacted by climate change the most?