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Education for youth climate action

Co-creating design principles and learning goals of a climate change education program in Slovakia

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ABSTRACT

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The climate crisis is humanity's greatest challenge so far, and resolving it requires nothing short of a wide-scale societal transformation. Education is considered a key enabler of this transition. Nevertheless, there is no consensus on what climate change education should entail and how to translate it into practice. At the same time, young people, who perceive climate change as the biggest threat to their lives, are willing to but lack adequate support to engage in climate action actively and meaningfully. The thesis aimed to bridge these gaps by setting learning goals and determining the essential design principles for a non-formal education program in Slovakia, emphasizing youth climate action.

Mixed-method research was applied, combining a Delphi study with expert interviews. Understanding climate change requires making sense of diverse interactive perspectives, and thus a Delphi expert panel of seventeen Czech and Slovak climate change and education expert was established. The experts took part in three survey rounds, seeking agreement on what knowledge, skills and values should young people develop to engage in climate action effectively and proactively. Additionally, four semi-structured expert interviews with international climate change professionals complimented the Delphi study findings.

Six design principles should guide the education program: (1) exploration of own frames of reference, (2) reinforcement of climate-positive social norms, (3) purposeful cultivation of individual and collective efficacy through project-based learning, (4) futures-thinking, (5) balance of individual and collaborative learning, and (6) ongoing dialogue between various perspectives on climate change. The Delphi study identified sixty-two highly prioritized items, ranging across the understanding of the climate system, climate justice, causes and impacts of climate change, media and information literacy, lifestyles, politics and citizenship, mental health care, and values. The expert interviewees revealed additional themes of power, alternative futures, and calls for the education program not to be prescriptive so that each learner can find their unique position in addressing the climate crisis. The results were organized and presented within the taxonomy of significant learning. Finally, it summarized what foundational knowledge learners should have, how it should be applied and integrated, the human and caring dimensions of learning, and vital learning skills.

Key words: climate change education, learning goals, youth climate action

CONTENTS

1 INTRODUCTION

Human induced climate change presents us with a challenge like no other. It is a perfect example of a wicked, even super-wicked problem (Lehtonen, Salonen & Cantell 2018; Lazarus 2009). It is dynamic, complex, intangible yet manifesting across space and time. Without unprecedented, “rapid and far-reaching” transformation within all aspects of our society and the economy, we are risking “long-lasting or irreversible changes” to the life-sustaining systems of our planet (IPCC 2018; Rockström 2020), and a “ghastly future” awaits (Bradshaw et al. 2021, 2).

The worst-case scenarios for the planet and humanity are, however, still avoidable. By now, the contours of the required transformative change are well known, but not implemented at a sufficient scale. To drive this transition, education is often presented as an “untapped opportunity to combat climate change" (Anderson 2012, 193). Ironically, as Philip Vaughter (2016, 2) of the United Nations University points out, "it is often the most educated that lead the most carbon-intensive lifestyles, suggesting it is not more education that is needed, but different education." Yet, despite the many calls for quality climate change education, there is little agreement on the learning goals, practice, or assessment of climate change education (Reid 2019, 767).

1.1 Research aim, questions, and objectives

The principal aim of this thesis is to explore what kind of education supports learners in facing the "colossal challenges" (Bradshaw et al. 2021, 6) posed by climate change. This thesis seeks to answer the following two research questions:

1. What educational design principles support learners in engaging with climate change effectively and proactively?
2. What learning goals should climate change education pursue?

The research findings will act as a cornerstone of a climate change education program to be implemented in Slovakia. Since the causes and impacts of climate change are very complex, as is one's individual and collective role in responding to it, the educational program should design for this complexity. According to a systematic review of literature on the effectiveness of climate change education strategies, educators should create "an atmosphere that is welcoming to a diversity of perspectives on climate change, while dispelling students' misconceptions about climate science" (Monroe et al., 2019, 805).

To address for this complexity and diversity of perspectives, an interdisciplinary panel of seventeen Czech and Slovak climate change and education experts was invited to participate in a three-round Delphi study to reflect and reach a consensus on what the learning objectives of climate change education program should be. Additionally, four expert interviews were conducted with international climate change professionals.

1.2 Thesis structure

The first part of this thesis, as an extension of the introduction, presents the contextual background and motivations for the creation of the educational program. It reflects on the origins of climate change education and its dominant characteristics and provides an overview of the state of both formal and non-formal climate change education in Slovakia. The following chapters reflects on the various forms of climate action and present diverse factors that are known to motivate such action, along with behavioural models that are commonly used to explain pro-environmental action. The factors are then summarized put in context by presenting the bicycle model of climate change education.

The second part describes the Delphi research methodology and presents the findings from all three rounds of the Delphi study employed in this research. Additionally, findings from four semi-structured expert interviews compliment the results of the Delphi study. In the final, discussion part, the research findings are

formulated as learning goals according to L. Dee Finks' (2013) taxonomy of significant learning.

2 CONTEXTUAL BACKGROUND

2.1 The urgency of climate change

For life as we know it to evolve and for human society to develop, our planet has provided relatively stable atmospheric and biogeochemical conditions for more than eleven-thousand years (Rockström et al., 2009, 472). This epoch of stability, called the Holocene, saw the rise of agriculture, human settlements, technological advancement and contemporary civilisations. Human activity has since become the dominant force altering our Earth's functions, threatening the very stability that enabled humanity to thrive. More than 70% of the planets terrestrial surface has been altered by humans (Scholes et al. 2019). Ceballos and colleagues (2015, 1) have confirmed that "a sixth mass extinction is already underway."

The concentration of atmospheric greenhouse gases (GHGs) is rising at an unprecedented rate due to human activities. Evidence shows that the current atmospheric carbon dioxide concentrations are the highest in more than 7 million years (Cui, Schubert & Jahren, 2020, 890). Scientists agree that the human-induced increase in GHG concentrations is the primary driver of climate change (Oreskes, 2004; Cook et al., 2013). Perhaps the loudest alarm was sounded by the Intergovernmental Panel on Climate Change (IPCC) in 2018, who urged the global community to halve global carbon emissions by 2030, making this decade the “most important in our history.” The severity of the challenge ahead is indisputable and accepted by scientists and increasingly by policymakers as well. The European Parliament has, for example, declared a state of climate and environment emergency on the 28th of November 2019 (European Parliament, 2019). How can education respond to a world in climate emergency?

2.2 Origins of climate change education

The first high-level policy acknowledgement of education in addressing climate change appeared in 1994 in the United Nations Framework Convention on Climate Change (UNFCCC). This international treaty, signed by 154 UN member

states, was the first UN-wide attempt at stabilizing greenhouse gas concentrations in the atmosphere. The treaty recognized education, training and public awareness in mitigating the “dangerous human interference with the climate system,“ calling on countries to develop education and awareness programmes or to support “public participation in addressing climate change and its effects“ (UN General Assembly, 1994). The 2015 Paris Agreement reemphasized this call 23 years later. Furthermore, the improvement of “education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning“ in one of the 179 targets of the Sustainable Development Goals, accepted by 193 UN members states.

Despite formal actions taken through international frameworks, agreements, and strategies over the past three decades, ”it is clear that the provision of climate change education nationally, regionally and internationally is found wanting in many regards“ (Reid 2019, 770). The formal recognition of the importance of climate change education does not automatically lead to effective implementation on the ground. One of the principal reasons is that, when it comes to climate change education, the quality and extent of action taken within these treaties' framework is determined by each country individually. What is more, the succinct and vague descriptions of these goals are generally up to each country's interpretation.

In 2019, UNESCO analysed how countries implemented their responsibilities under the UNFCCC and the Paris Agreement. They analysed two kinds of reports that countries submit to the UNFCCC Secretariat, the so-call National Communications on the progress achieved and the Nationally Determined Contributions which countries prepare every five years to outline their climate-related plans. UNESCO found that 100% of the reports submitted from Europe mentioned some climate change educational content (UNESCO 2019, 5). Public awareness-raising was the most common approach, followed by formal education, training, public access to information, international cooperation, while the least represented element was public participation (UNESCO 2019, 6). UNESCO, analysing references to formal climate change education, found that the cognitive component of learning prevailed over behavioural, or the social and

emotional dimensions. Interestingly, climate change education was more prevalent in the National Communications that examine past actions than in the Nationally Determined Contributions that address future plans (UNESCO 2019, 11). The extent and the effectiveness of these interventions are difficult to assess, as only 30% of the submitted documents included any quantitative data on climate change education.

Climate change, unsurprisingly, is a particularly challenging topic to teach as it spans complex scientific, social, political, economic and ethical dimensions. Besides, outright climate change denialism, scepticism and misconceptions proliferate in the public discourse. Addressing climate change may be different from approaching other environmental issues, as it resonates with deeply held values and group identity and can quickly become a political topic "too close to advocacy for classroom educators to address" (Monroe et al. 792). Nevertheless, scholars argue that engaging with the politicised nature of climate change is essential so that the "youth can begin to work towards more effective solutions than have come from older generations" (Zummo et al. 2020, 1222).

Young people worldwide have become vocal climate advocates, as witnessed by the fourteen million young strikers at the Friday for Future events (Fridays for Future 2021). They demand climate justice and equity, keeping the global temperature rise below 1.5 °C compared to pre-industrial levels and urging decision-makers to listen to the best united science currently available (Fridays for Future, 2019. 3). While some young climate activists are very well-acquainted with the threats that climate change poses to their future, they learnt about them on their own and not in schools. For this reason too, Slovak climate activists have demanded the introduction of compulsory climate change education schools.

2.3 Formal climate change education in Slovakia

Within the Slovak formal education system, environmental topics are addressed in the form of a cross-sectional theme. According to the Slovak National Pedagogical Institute (2017), environmental education enables the acquisition of knowledge, skills and attitudes for nature protection and sustainable

development. Through environmental education, students should understand the complex relationship of humans and the environment, recognizing ecological, economic, and social aspects of this relationship.

The methodological guidance for the implementation environmental education, however, is succinct and vague. It does not mention climate change. Whereas schools may choose to implement environmental education as a standalone subject, infuse it across all the subjects, or implement specific environmentally themed projects, there is little to no advice on how to do it in practice. The content, and quality of environmental education in Slovak schools is thus variable, and often depends on the personal motivation, dedication, and creativity of the responsible teacher (Petlušová & Nozdrovická, 2018; Šebová et al. 2020). Additionally, since environmental education is not formally monitored, there is a lack of comprehensive and representative data on its nation-wide implementation and effectiveness.

Even though, or perhaps because climate change is not addressed as a strategical priority, climate change education has begun to gain research, policy and practical attention over the past years. In 2019, focusing on the three least developed districts in Slovakia, Friends of the Earth Slovakia analysed to what extent are the themes of climate change and the energy system incorporated into the formal education system. The Slovak education system, they found, does not guarantee the understanding of climate change fundamentals (Priatelia Zeme-CEPA, 2019, 3) and the topic is not addressed to a sufficient extent nor in an age-appropriate way. Coverage of climate change, furthermore, does not reflect the practical implications for the immediate nor the future life of young people (ibid).

The outdated coverage of current global and environmental issues within the Slovak national curriculum was recently highlighted by the analytical institutes of the Environment and Education Ministries (Bodáczová, Engeľ & Sedláček, 2021). They found that learning standards focus on description or identification of issues, with less attention paid to the analysis, discussion, comparison, or argumentation. The topic of climate change is covered as part of high school geography with regards to climate zones. In contrast, the depletion of the ozone-layer is re-occurring multiple times, despite its gradual recovery. According to the

2018 PISA results in global competency, 58% of Slovak students would have trouble explaining how CO_2 emissions contribute to global climate change (Mann et al. 2020).

Kurka Ivanegová, Križan and Šebová (2021) surveyed nearly 500 Slovak primary and secondary school teachers to learn about how they approach climate change. Most teachers considered climate change to be the largest global threat, whereas it was not so significant when considered in a local context. This may indicate that teachers still consider climate change to be a somewhat distant menace. Environmental challenges seem to be taught in isolation. The growing amount of waste, along with nature conservation are the most represented environmental topics. Only a quarter of high-school teachers engaged with climate change, while the least represented topics were biodiversity loss, environmental activism, sustainable development, and soil degradation.

It is important to highlight that Slovak teachers do not receive pre-gradual, or in-service training in environmental education, and the teacher survey revealed how most of them, 70% primary school and 58% secondary teachers, learn alone and in their free time (Kurka Ivanegová et al. 2021, 11). Correspondingly, the greatest barrier to climate change education, according to the teachers, was the lack of professional education opportunities, along with the absence of appropriate educational materials (ibid 30). However, teachers also recognized the current framing of learning standards as a limiting factor. Encouragingly, the survey revealed broad teacher support for the introduction of climate change education. Most teachers would welcome increased effort from government authorities in support of climate education (ibid, 14).

The Green Restart initiative (Zelený reštart 2021), which unites multiple expert environmental organisations, has advocated for the inclusion of robust climate and ecological measures within the 5,84 billion euros worth COVID-19 recovery and resilience plan. The Green Restart has published a set of recommendations for the education sector, which included, to name a few, the revision of the national curriculum reflecting the urgency of the climate emergency or the introduction of pre-gradual and in-service teacher training on climate change education.

As a matter of fact, a curricular reform may well be on its ways and its basic contours are outlined in the Slovak recovery and resilience plan. The innovated curriculum should meet the needs of contemporary society, by raising literacies and skills needed for a life in a global, low-carbon and digital economy. Due to pressure from environmental organizations, the Recovery and resilience plan now explicitly recognizes the challenges posed by climate change, along with digitalization and automatization. The new curriculum should, in addition to raising critical thinking skills and improving results in international testing, include topics from environmental and climate change education. The Recovery and resilience plan, approved by the Slovak Government on April 28, 2021, is thus the first official policy document to recognize the terminology of climate change education.

2.4 Non-formal climate change education in Slovakia

While non-formal education programs are generally more progressive, there is only a limited offer of climate-change focused educational programs. The Slovak Environment Agency, a public institute pertaining to the Ministry of the Environment, offers short-term activities, ranging from a couple of hours activities in regional schools to three-day long workshops. Their Dropie eco-centre, which is embedded into a rural, agricultural landscape, is now transforming into a Climate-Change Living Lab. The living lab will demonstrate exemplary climate adaptation and mitigation and measures, with the goal to inspire local authorities and the public.

Several organizations develop trainings for environmental educators. For example, the Center of Environmental Activities in Trenčín has just recently presented a set of educational materials which combine elements of environmental education, with active citizenship and media literacy. One of the modules is specifically dedicated to the climate crisis. Non-governmental organization SOSNA is running a successful programme for teachers called Climate gardens help the climate. Through the program, teachers not only learn about climate change, but also about practical measures they can implement to

curtail climate change. Friends of the Earth offers a four hour-long training about what schools should teach in the context of peak oil and climate change.

Young Slovaks lack opportunities to attend continuous and organized longer-term climate-change education programs. Perhaps the only exception is the to-be launched year-long Climate Ambassadors programme organized by BROZ, the Bratislava regional conservation association, in cooperation with the Green Foundation. Twelve individual young people, or pairs, will receive mentorship and guidance on how to plan and implement their own climate-related projects. The author of this thesis will be one of the mentors. This program is project- and leadership oriented, participants learn about project management, fundraising, or about how to interact with local authorities. There is no set curriculum for the program, rather, learning goals will emerge according to the needs of the project teams.

2.5 Motivations for a standalone climate change education program

In efforts to reach climate neutrality by 2050, countries, including Slovakia, are expected to restructure and decarbonize their economies (European Commission, 2019). For this to succeed, people should cultivate knowledge, skills, and competencies to support the zero-carbon and sustainable transition. Jobs that are "green "are already on the rise. However, young people in Slovakia rarely consider employments in sectors associated with sustainability or climate protection. Nearly half of the jobs that Slovak teenagers dream of doing in the future are at risk of becoming automated (OECD 2020, 8).

Slovak youngsters care about the environment and the climate, but they lack guidance and opportunities to engage with climate-related topics more in-depth. They cannot yet count on the formal education system, and even though some non-governmental organizations and public institutions are beginning to offer climate-related programs, as shown in the previous section, these programs may be too short-term to address the super-wicked problem of climate change. The anticipated long-term Climate ambassador mentorship program of BROZ and

Green Foundation, with its explicit project-oriented focus, holds great potential. However, only twelve lucky ones will be selected to participate.

The motivation to create a standalone, non-formal climate change education program in Slovakia emerged in the spring of 2020 from the discussions between one of the Fridays for Future movement's co-initiators and the thesis commissioner, sustainability consultancy SUSTO- Sustainability Tools. Both actors recognized the urgency of climate change, the voice of young people who will bear an increasingly heavy load of climate impacts on their shoulders, along with the existing barriers to action. While young people were getting louder and taking it to the streets to demand robust climate policies, the young climate activist also felt a need to show his peers there were many other diverse ways of climate engagement.

Recognizing that a curriculum always “represents somebody's version of what constitutes knowledge and a legitimate worldview” (Sleeter & Grant 1991, 80), it is necessary to clarify what worldviews and principles form the cornerstone of the curricular design that is the subject of this thesis. The thesis commissioner, together with the young climate activist, verbalised their joint mission as nourishing the determination of young people to engage in climate action. The program should be built on values, youth agency, diversity of perspectives, systems thinking, and should demonstrate that caring for the climate is possible and within youth's reach.

The author of this thesis, who is member of the commissioner organisation, recalls one of their early heartfelt discussions, during which they envisioned an educational program that addresses the interlinkages of the climate crisis and correspondingly presents multiple entry points and solution spaces for climate protection. We imagined how such an education program could help young people who struggle with climate anxiety by providing a positive and hopeful perspective, by showing the many diverse solutions that are already out there.

Last but not least, we envisioned a program that could support youth agency and catalyse the creation of many youth-led climate projects across our region. Throughout this thesis, the author refers to agency as young people's purposeful

and active engagement in shaping their world for the better. “In the context of solving the climate crisis”, our young activist colleague adds, “we need to rethink *the way we are,* and youth is ready to do that. Without any *quit pro quo* deals, without the superficial and insufficient changes, but by giving rein to a just and climate-friendly transformation of our society” (E-mail correspondence, confidential, May 2021).

3 THEORETICAL BACKGROUND

3.1 How does climate change education differ from environmental education and education for sustainable development?

Climate change education has been interpreted in many diverse ways. Cutter-Mackenzie-Knowles and Rousell (2019) conducted a systematic literature review of climate change education literature published between 1993 and 2014. Most of the research, they found, focused on a scientific understanding of climate change, and concerned STEM disciplines, mostly referring formal science-education (Cutter-Mackenzie-Knowles and Rousell 2019, 198). This strand of literature tends to focus on increasing the science literacy of both teachers and students, and with addressing common scientific misconceptions regarding climate change.

Environmental education was, not surprisingly, the second largest subcategory dealing with climate change education. Environmental education generally focuses on encouraging pro-environmental behaviours, and on minimizing the negative influence of people on the environment. Over the examined period, Rousell and Cutter-Mackenzie-Knowles (2019, 199) noted a shift from focusing on knowledge-based determinants of climate-friendly behaviour to other, more situational and affective motivators. They also identified “considerable tension around the emergence of climate change education as a standalone field alongside education for sustainability and education for sustainable development, among other sub-disciplines of environmental education” (Rousell and Cutter-Mackenzie-Knowles 2020, 1999).

Multiple studies have called for the integration of climate change education within the framework of education for sustainable development (Anderson 2012; Læssøe and Mochizuki 2015; Mochizuki and Bryan 2015). Education for sustainable development (ESD), as the UNESCO (n.d.) explains, “empowers learners to change the way they think and work towards a sustainable future.” Described a holistic, learner-focused, and activizing approach, ESD has been widely endorsed by countries and international institutions since the turn of the

millennium. The years 2005-2014 were declared as the UN Decade of ESD. Environment and Education Ministries from the UN Economic Commission for Europe adopted a special ESD strategy in 2005 and were encouraged to step up and integrate ESD into formal, informal and teacher, and other vocational education. In the second half of this special decade, the so-called climate change education for sustainable development became the strategic focus of UNESCO. The decade was successful to a varying degree. While some countries achieved great progress in line with what was outlined in pompous strategies, other signatories, like Slovakia, did not make any noticeable progress.

Despite its appeal and strong institutional backing, ESD has also been subject to criticism. The underlying critique revolves around the “definitional haziness” (Selby and Kagawa 2010, 38) of its core component, sustainable development. The notion of sustainable development has been criticized for being an oxymoron, especially for the ongoing conflict between socio-economic development and ecological integrity (Spaiser, Ranganathan, Swain & Sumpter, 2017). Likewise, ESD has been called out for not being an appropriate tool for tackling current issues. Scholars argue that it exhibits a strong anthropocentric bias (Kopnina 2012) that does not challenge the status quo, especially the neoliberal market ideology, that created the social and climate crisis in the first place (Jickling 2005; Jickling & Wals 2008, Selby and Kagawa 2010). As Kopnina and Meijers (2012, 193) illustrate, ESD may represent an implicit paradox of “*having your cake and eating* approach by both maintaining a growing and increasingly wealthy population and protecting the environment.“

Cutter-Mackenzie and Rousell (2018, 101) argue that climate change education presents a distinct, emerging field that is “fundamentally responsive and accountable to the rapidly changing environmental conditions“, and thus should not be considered a subcategory of ESD nor environmental education. Mainstream environmental education has mostly been concerned with individual level, private-sphere action, which is also not sufficient to address the systemic and interlocked issue of climate change (Jorgenson, Stephens and White 2019; Kagawa and Selby 2010; Waldron et al. 2019). Neglecting the impact of collective action, environmental educators may be “reinforcing a simplistic and narrow conception between climate change, human action, and energy system change,”

explain Jorgenson and colleagues (2019, 166). Put simply, while mainstream environmental education might focus on changing lightbulbs and switching the light off, in terms of fighting climate change it would be more significant to consider how to decarbonize our energy systems. Wynes and Nicholas (2017, 7), who highlighted how textbooks often omit impactful climate action, warn that a focus on personal low-impact action may "create the impression that the issue of climate change itself is trivial in nature, and represent missed opportunities to encourage serious engagement."

Climate change education, too, appears to be a wicked problem (Cantell, Tolpannen, Aarnio-Linnanvuori & Lehtonen 2019, 717). It is complex, with no simple solutions, imbued with contradictory interests and understandings. For example, Waldron, Ruane, Oberman and Morris (2019) in their exploratory study encounter two opposing way of approaching climate change education. While teachers perceived climate change as a geographical process "with private actions as possible solutions," environmental specialists viewed it as "a global injustice requiring political, social and economic mobilisation."

Kagawa and Selby (2010, 5) consider facing this wicked problem as a valuable "learning moment [that] can be seized to think about what really and profoundly matters, to collectively envision better futures, and then to become practical visionaries in realizing that future." Understanding what matters requires a deep understanding of the world around us and engaging with personal values and the values of others. The capacity to envision a better future implies an understanding of what in the presence needs to be improved. Thus, thinking critically about our world is an integral component of climate change education (Waldron et al. 2019, Cantell et al. 2019, Karsgaard and Davidson 2021). This includes "unpacking and critiquing" how the dominant economic model and consumerist culture are "putting the world at risk" (Kagawa and Selby 2010, 241). Such critique should be constructive and inspire alternative solutions. Becoming practical visionaries implies cultivating agency and taking climate action, be it in schools, or in the public domain (Cutter-Mackenze & Rousell 2018, 91). The following part reflects on the diverse ways in which climate action can be interpreted.

3.2 Understanding climate action

Climate change is becoming a top concern of young Slovaks. When asked to rate the most pressing issues facing Slovakia, it turned out to be the fourth most severe issue out of twenty-seven options. Climate-concern followed low wages, corruption and the worrisome connection of some politicians with organized crime (Ministry of the Interior of the Slovak Republic & The Office of the Plenipotentiary for the Development of the Civil Society 2019, 237). Youth do not only worry; it seems they are also considering standing up to the challenge.

A recent survey conducted by IUVENTA (2021), the Slovak Youth Institute, found that most high schoolers would take an active stance to curtail or reverse the threat of climate change. Tackling climate change requires unparalleled effort and transformative action, and as the Intergovernmental Panel on Climate Change explains (2018), “there is no historical precedent for the scale of the necessary transitions, in particular in a socially and economically sustainable way.” What kind of action could live up to the challenge of curtailing climate change?

3.3 Environmentally significant behaviour

In 2000, Paul C. Stern, current president of the Social and Environmental Research Institute, developed a conceptual framework for the theory of environmentally significant behaviour. Stern advised to define such behaviour by its impact, by “the extent to which it changes the availability of materials or energy from the environment or alters the structure and dynamics of ecosystems or the biosphere itself” (Stern 2000, 408). An environmentally significant behaviour, from the perspective of climate change, could perhaps broadly be characterized by the extent it mitigates the adverse effects of climate change.

Environmentally significant behaviour is not uniform, and Stern discerned four distinct types. The first type, environmental or in this case climate activism, represents committed and active involvement in environmental organizations, or in the environmental or climate movement. Movement activists often engage in public actions aiming to influence the entire policy or economic system (Stern,

Dietz, Abel, Guagnano and Kalof 1999, 82). As Fisher and Nasrin (2020, 2) further explain, climate activists target “nodes of power,” by exerting pressure on political and economic stakeholders to lower emissions, for example through litigation or lobbying activities. However, they also employ a diversity of confrontational tactics, or non-violent direct actions (Fisher and Nasrin 2020, 5; Gershuny 2019).

The second type of environmentally significant behaviour refers to nonactivist behaviours in the public sphere and highlights how individuals can influence their role of citizens (Stern 1999; Stern 2000; Wolske & Stern 2018). This type may entail “low-commitment active citizenship” (Stern et al. 1999, 82), such as signing petitions, or joining protests organized by committed activists. This behaviour also includes the endorsement of environmentally significant public policies and legislation, including the willingness to pay higher taxes in favour environmental protection (Stern 2000, 409), but also the opposition harmful practices, such as subsidizing the fossil industry.

Private-sphere environmentalism is the third type of environmentally significant behaviour, and it refers to individual and household behaviours, such as conscious and sustainable consumption practices, which may, for example, include purchasing products with environmental labels. Private-sphere environmentalism may also include lowering the energy intensity of a household or minimizing and eliminating waste generation, just to mention a few practices.

The fourth kind of environmentally significant behaviour highlights how individuals can influence organizational processes as employees or managers in favour of environmental or climate protection (Wolske & Stern 2018, 129; Stern 2000; 410). Nowadays, there are many opportunities for such professional, environmentally significant behaviour, for example, engineers and designers could apply circular and eco-design principles in their everyday work, businesses could address the sustainability and fairness of their supply chains, bankers could consider the environmental, or climate impacts of their investments, farmers could transition to agro-ecological and regenerative agriculture, principals could strive to operationalize a whole-school approach to sustainability and climate change education.

Returning to Stern's advice to define environmentally significant behaviour through its impacts, one may examine whether a particular action influences greenhouse gas emissions directly or indirectly. To illustrate, climate action can target greenhouse gas emissions directly, by reducing dependency on fossil fuels, for example by shifting to renewable energy sources or through rejecting individual automobility. Indirectly, one may focus on excluding or minimizing the use of products and services, which rely on fossil fuels within their lifecycles (Wolske & Stern 2019). Avoiding a “ghastly future” requires limiting global average temperature rise within the 1,5°C boundary; this calls for a drastic reduction of carbon emissions. Therefore, being able to distinguish between climate action with low, versus high impact on climate change mitigation is thus of utmost importance.

3.4 BIG problems

Slovak high school students expressed their intention to tackle climate change, but would this intention translate into practice, and if so, how effective would it be to reverse climate change? It is critical to understand that an intention protect the planet does not automatically lead to action with significant impact on the climate (Gifford, Kormos & McIntyre 2011; Csutora 2012; Moser & Kleinhückelkotten 2018; Stern 2000; Stern & Wolske 2018; Hitchings, Collins & Day 2015). Observing no significant difference between the ecological footprints of “green” and “brown” Hungarian consumers, Mária Csutora (2011) named this phenomenon a behaviour-impact gap problem. She explained that a behaviour-impact gap problem, with a touché acronym *BIG problem*, is “confronted whenever the required behavioural change is achieved, but the observed ecological effect is minor or missing” (Csutora 2011, 148). Köhler, Whitmarsh and Hanss (2020) further elaborate that a behaviour impact gap may result from an inaccurate belief that “engagement in few low impact pro-environmental behaviours is an adequate contribution to environmental protection.”

BIG problems seem to be very common. For example in Germany, Moser and Kleinhückelkotten (2018) explored how the relationship between environmental

intent, and the actual environmental impact of more than a thousand adults. Surprisingly, perhaps even controversially, they found that people with a higher environmental self-identity “used slightly more energy and had a slightly bigger carbon footprint than those indicating less environmental awareness” (Moser & Kleinhückelkotten 2018, 645). This discrepancy may be caused by what the researchers called the “income effect”, the observation that “both environmental impact and environmental self-identify increases with rising income” (Moser & Kleinhückelkotten 2018, 647). Another explanation could be the possibility that individuals may not report their environmental behaviours accurately, potentially out of social desirability or other response biases, or they just simply don't know the actual environmental impact of their actions (Gifford, Kormos & McIntyre 2011, 6).

It is important to recognize that people may engage in environmentally significant activities, such as saving energy, even though they would not frame their engagement as environmental (Hitchings, Collins & Day, 2015). Gifford and colleagues (2011, 6-7) use a simple comparison to illustrate such “inadvertent environmentalism.” A low-income person, who doesn’t express much concern about the environment, may live in a smaller apartment, use less energy and be a modest consumer. In contrast, a higher-income, environmentally conscientious person may live in a house full of Energy star appliances. The overall environmental impact of the lower-income person could still be considerably lower.

Adopting a narrative of impact is not yet a common practice within educational setting. Seth Wynes and Kimberley A. Nicholas (2017) reviewed science textbooks and government documents and examined what sort of climate action they recommended. High-impact actions, those with the best potential to lower individual greenhouse gas emissions, such as eating a plant-based diet, or living car-free, where largely absent from these documents (Wynes & Nicholas 2017, 7).

The envisioned education program should recognize the many diverse faces of climate action, including ways to determine their impact. A focus on impact does not dismiss the role of smaller, lower-impact action but it illustrates how each

action fits in the bigger picture. Encouraging youth to reflect on the impact of their actions, as Stern and Wolske highlight (2017, 2), “could have considerable value by stimulating serious and better-informed discussion of how they might make a difference in limiting climate change.“

3.5 What motivates climate action?

Since the goal of the envisioned education program is to empower young people and cultivate their agency, the following chapter explores what is known to motivate climate-friendly behaviour. However, understanding such is “dauntingly complex“ (Stern et al. 2000, 422), and it is necessary to consider multiple variables.

This chapter reflects on the importance of personality traits (what people are like), values (what people consider important), beliefs (what people consider true), personal and social norms (what people consider right and wrong). Recognizing the unavoidable interaction of the elements mentioned above and drawing from the field of social psychology, this chapter presents influential behavioural models that have proven helpful in explaining pro-environmental behaviour.

3.6 Knowledge

A lack of significant pro-environmental action is often associated with a lack of knowledge. This notion often referred to as the information-deficit model, sounds logical. The more we know about environmental problems, the less likely we are to harm the environment. Should we better understand the adverse consequences of climate change, we would decrease our carbon-intensive lifestyles. Environmental and climate policies advocate for increasing knowledge about climate, awareness-raising and education, believing in seemingly straightforward, easily implementable cognitive fixes, which suppose people will change themselves in response to new information (Heberlein 2021, 164; Madden, Cacciatore & Yeo 2016, 409). However, learning and reinforcing new,

including pro-environmental behaviours, entails much more than the assimilation of information and knowledge.

Should the answer to climate action be as straightforward as increasing knowledge, we would not be witnesses to what Daniel Sarewitz (2011) refers to as “an enormous evidentiary embarrassment.” Climate change knowledge has been increasing over the past decades, and so have, simultaneously, greenhouse gas emissions. CO2 levels are now at their highest atmospheric concentration in the past 3.6 million years (NOAA, 2021), and energy-related carbon emissions are “heading for their second-largest increase ever”, warns the International Energy Agency (2021).

Though it may appear contradictory, the very nature of scientific knowledge could take part of the blame. Vainio and Paloniemi (2011, 386) point out how emerging scientific understanding becomes inherently uncertain and complex. This inherent complexity of climate science may lead to uncertainty in public understanding, thus as Whitmarsh’s research (2009, 417) suggested, “uncertainty can be a product of knowledge rather than of ignorance.“

Research-based on the Gallup World Poll across 119 nations determined that educational attainment was the “single strongest predictor of climate change awareness” (Leet et al., 2015). Paradoxically though, more education does not necessarily lead to a consensus on climate change. In a US context, Drummond and Fischoff (2017, 9590-91) showed that education – whether measured in terms of general science education attainment or science literacy scores, may increase rather than decrease polarization. This surprising finding could be attributable to two mechanisms. According to the first one, more educated individuals could be more adept at interpreting evidence supporting their preferred conclusions. The second mechanism considers a potential miscalibration of one’s perceived knowledge, referring to situations in which “individuals’ confidence in their knowledge is only weakly correlated with its actual extent” (Drummond & Fischoff, 9588).

In the face of these and other “knowledge paradoxes“ (Whitmarsh 2009, 417), such as the unexpected findings of Kellstedt, Zahran and Vedlitz (2008) that

confidence in scientists could even decrease concern for global warming, the information-deficit model has been widely criticized (Suldovsky, 2017; Whitmarsh 2009, Kellstedt et al. 2008) as insufficient and has even been proclaimed dead (McDivitt, 2011). While the importance of knowledge in behaviour change is undeniable, “it is rarely sufficient“(Marteau, Sowden & Armstrong, 69). Other factors, or their combination with knowledge, have proven to be more helpful in explaining what motivates pro-environmental and climate action.

3.7 Beliefs – What people consider true

The nature of climate change distinguishes it from other environmental problems (Vainio & Paloniemi 2011; Roberts, 2013). Climate change is an intangible yet all-permeating phenomenon, with diverse manifestations across space and time. Philosopher and ecological theorist Timothy Morton (2013, 1) considers global warming to be a hyberobject, an object “massively distributed in time and space relative to humans.“ Morton pinpoints how even though people never directly experience global warming, they experience isolated weather events, climate change sticks to every one of us no matter where we are (Morton, 2010). Given its complexity, it can be easily misinterpreted, even disregarded as no big deal, or as the responsibility of someone else, of government institutions or other countries, to solve.

Annuka Vainio and Riikka Paloniemi (2011) explored how the combination of climate change belief and knowledge of climate change, post-materialist values (valuing nature in itself over material goods), and trust in politics affected the climate mitigation behaviour of Finnish adults. They found that knowledge and post-materialist values alone did not predict mitigation behaviour unless people believed in man-made climate change (Vainio & Paloniemi 2011, 90). Interestingly, they also found that distrust in politics encouraged mitigation action. On the other hand, trust in politics decreased climate mitigation behaviour and belief in climate change, implying a mechanism of systems justification, defending current social arrangements (Jost & Banaji, 1994), even though these arrangements might have negative environmental consequences.

Others, too, have accentuated the essential interlinkage of belief with action. For example, Dietz and colleagues (2007, 208-209) found that those who believed in the adverse effects of climate change on people and the environment demonstrated more significant support for climate mitigation policies. On the other hand, a lack of belief in climate change was linked to apathy for environmental action (Heath and Gifford, 2008).

The seemingly critical role of beliefs raises the epistemological question of the difference between knowing about climate change and believing in it. One must recognize that the relationship of knowledge and belief has been a topic of great debates amongst philosophers, at least from Plato's time. Hence, the following sentences attempt to address only a tiny fraction of this great question. A belief is something the believer personally understands to be true. Wayne (2017, n/a) explains that a "belief is an involuntary action occurring after our own internal standard for evidence has been met." Notably, a belief need not be scientifically accurate, or, as Heberlein (2012, 16) explains, "it can be inconsistent with scientific knowledge or the knowledge of an authority, but if people believe it, then it is true for them." On the other hand, knowledge could generally be explained as "the small fraction of our beliefs that actually meet the scientific standard of evidence" (Wayne, 2017).

3.7.1 Ideological determinants of climate change beliefs

Climate change belief, what one considers to be true about climate change, is affected by a great diversity of variables – demographic, cognitive, psychological, human-evolutionary (Milfont et al. 2015; Brownlee et al. 2013) - while cognitive variables "may be shaped by, or trumped by, ideological factors" (Hornsey et al. 2016, 623). In 2016, Hornsey, Harris, Bain and Fielding presented the first meta-analytic exploration of demographic and sociological factors of belief in climate change. They explored 27 variables across 25 polls and 171 academic studies conducted in 56 countries. Their research revealed how the most significant demographic predictor of climate change (dis)belief is political affiliation and identification with political parties. In their words, "people who intend to vote for more liberal parties are more likely to believe in climate change than those who

align themselves with relatively conservative political parties" (Hornsey et al. 2016, 622).

The liberal-conservative divide in climate change (dis)belief seems to permeate all aspects of the climate debate. Cary Funk (2017), director of science and society research at Pew Research Center, while reflecting on the results of the 2016 U.S. Gallup Poll, noted how Republicans and Democrats significantly differed in their views "from the causes and potential cures of climate change down to people's trust in climate scientists' understanding of the issue and the motivations behind their research." Similar results are observed in other geographical contexts as well. For example, Krange, Kaltenborn and Hultman (2019) found that conservative Norwegian males embrace denial beliefs considerably more than the rest of the population" (page number N/A). Milfont and colleagues (2015, 22) showed how self-reported New Zealander conservatives were more likely to be undecided or sceptical about climate change when compared to their liberal counterparts.

Aware of this political divide, Hess and Maki (2016) wondered what effect, if any, does college-level climate education have on self-identified conservatives (Hess&Maki 2016, 1158). Following the so-called selective exposure bias, they found that conservative students were less likely to attend climate-related courses, which could challenge their views (Hess & Maki, 1161). They also investigated if those conservative students who attended climate-related classes, whether by choice or by curricular requirement, were more resistant to change their initial beliefs or disregard received climate change information (Hess & Maki 2019, 1158).

Their results showed mixed evidence of resistance to belief change, with 13,4% of students who took a climate-related course not changing their mind and remaining sceptical of climate change. Approximately a third of the students reported an increase in their beliefs, while the remaining 54% reported no effect since they already believed in anthropogenic climate change (Hess & Maki, 1163). Importantly, their results further indicate that irrespective of political ideology, climate-sceptical students were more likely to alter their beliefs after attending a climate-related course.

Apart from political influences, researchers have identified other ideological orientations that affect pro-environmental and climate-friendly action. For example, Heath and Gifford (2006) were amongst the first to show how those who endorsed a free-market ideology were more likely to deny climate change, discount the human influence on environmental degradation, and how they were less likely to take pro-environmental action.

3.7.2 Pro-environmental worldview

What, then, characterizes a pro-environmental worldview? One of the most widely-used measures, the New Environmental Paradigm (NEP) Scale, was presented in 1978, in the decade when the US environmental movement was gaining prominence. On the first Earth Day, organized in 1970, 20 million people took to the streets protesting against environmental destruction (Yeo, 2020); the discussions regarding the limits to growth became dynamic (Meadows, Meadows, Randers & Behrens, 1972); significant environmental legislation was passed. Environmental sociologist Riley E. Dunlap wondered whether the public was shifting away from the dominant social paradigm, which at the time encompassed “beliefs in progress, material abundance and the goodness of growth; faith in the efficacy of science and technology; and a view of nature as something to be subdued“ (Dunlap 2008, 5).

Dunlap sensed a new environmental paradigm was emerging as “a direct challenge to the dominant social paradigm“ (Dunlap 2008, 6). Thus, Dunlap and Van Liere constructed the New Environmental Paradigm scale to measure this shift in paradigms. The scale was modified, updated and renamed as the New Ecological Paradigm in 2000 (Table 1). It includes 15 Likert items that reflect what the authors consider building blocks of an ecological worldview (Dunlap, Van Liere, Mertig & Jones 2000, 434).

Dunlap and colleagues (2000, 434) explain that “agreement with the eight odd-numbered items and disagreement with the seven even-numbered items indicates pro-NEP responses.” The New Ecological Paradigm remains a popular

tool in measuring environmental concern and attitudes. The meta-analysis of climate change belief determinants revealed the NEP as the strongest determinant out of the 27 variables surveyed (Hornsey et al. 2016, 623).

TABLE 1. New Ecological Paradigm Scale (Dunlap, Van Liere, Mertig & Jones 2000, 434)

	Do you agree or disagree that:
1	We are approaching the limit of the number of people the earth can support
2	Humans have the right to modify the natural environment to suit their needs
3	When humans interfere with nature, it often produces disastrous consequences
4	Human ingenuity will ensure that we do NOT make the earth unliveable
5	Humans are severely abusing the environment
6	The earth has plenty of natural resources if we just learn how to develop them
7	Plants and animals have as much rights as humans to exist
8	The balance of nature is strong enough to cope with the impacts of modern industrial nations
9	Despite our special abilities humans are still subject to the laws of nature
10	The so-called “ecological crisis” facing humankind has been greatly exaggerated
11	The earth is like a spaceship with very limited room and resources
12	Humans were meant to rule over the rest of nature
13	The balance of nature is very delicate and easily upset
14	Humans will eventually learn enough about how nature works to be able to control it
15	If things continue on their present course, we will soon experience a major ecological catastrophe

Recognizing that most of the research on polarized ideological perceptions of climate change focused on adult populations, researchers Stevenson, Peterson, Bondell, Moore and Carrier (2014) set out to explore if the interaction of worldview and knowledge influenced the climate risk perception of adolescents. Their positive findings, positive at least regarding the purposes of this masters’ thesis,

indicate that “climate-literacy efforts can overcome worldview-driven scepticism among adolescence, making them a receptive audience for building climate change concern” (Stevenson et al., 2014, 302). The difference between adult and youth perceptions may potentially lie within the “age-related window for influence”, that is, youth are in the process of forming their own identities, worldviews concerning the social world. As Gutierrez and Park (2015, 85) explain, the belief structures of adults change only in a minor way, “in emerging adulthood, however, worldviews remain in flux.” The educational intervention envisioned by this thesis could potentially impact worldview formation.

What other factors, apart from worldviews, may distinguish climate believers from deniers? Milfont and colleagues (2015) explored, on a large probability sample of more than 6000 New Zealanders, what socio-structural and psychological factors predicate two fundamental climate change beliefs, namely, that climate change is real and that is caused by humans. The *believers* were most likely to be younger, female, educated, politically liberal, belonging to minority groups and with a greater sense of self-efficacy (Milfont et al. 2015, 17). On top of these findings, their results point to another set of widely recognized and influential factors of pro-environmental and climate-friendly action, those of values and personality traits.

3.8 Personality – What people are like

Differences, and similarities between people, can be described in terms of their personality traits – habitual patterns of thoughts they have, emotions they feel and how they behave. One of the most popular personality theories, the five-factor model of personality, presents a spectrum of five broad personality dimensions: conscientiousness, agreeableness, neuroticism, openness to experience, and extraversion (Goldberg 1990; Wiggins, 1996). Openness to experience is often related to intellect or imagination, curiosity or seeking novel solutions. Conscientiousness reflects traits connected to long-term planning, self-discipline or thoroughness. Extraversion refers to the continuum from being outgoing and assertive to being an introvert. Agreeableness reflects “reciprocal social arrangements” (Milfont et al. 2015, 19) and is often associated with

altruism, kindness, cooperation with others. Finally, neuroticism refers to emotional stability and has been related to anxiety, insecurity, or depression.

TABLE 2. Overview of the Big Five personality traits and of accompanying characteristics (McCrae and Costa 2003, 53).

Personality trait	Low scorer	High scorer
Openness	Favours conservative values Judges in conventional terms Is uncomfortable with complexities Moralistic	Values intellectual matters Rebellious, non-conforming Has an unusual thought process Introspective
Conscientiousness	Unable to deny gratification Self-indulgent Engages in daydreams	Behaves ethically Dependable, responsible Productive Has high aspiration level
Extraversion	Emotionally bland Avoids close relationships Over-control of impulses Submissive	Talkative Gregarious Socially poised Behaves assertively
Agreeableness	Critical, sceptical Behaviour is condescending Tries to push limits Expresses hostility directly	Sympathetic, considerate Warm, compassionate Likeable Behaves in a giving way
Neuroticism	Calm, relaxed Satisfied with self Clear-cut personality Prides self on objectivity	Thin-skinned Anxious Irritable Guilt-prone

Multiple studies highlighted the positive correlation of agreeableness and openness traits to environmental themes. For example, Hirsh and Dolderman (2007) proved the link of these traits with greater environmentalism in Canadian

undergraduate students; Hirsch (2010) later found an association of these traits with environmental concern. Nisbet, Zelenski and Murphy (2009) found that these traits positively correlated with nature-connectedness. Milfont and Sibley (2012) found the agreeableness, conscientiousness and openness traits most strongly associated with environmental behaviour. Milfont and colleagues (2015, 25) showed that climate believers tend to have greater agreeableness and openness to experiences when compared to those who are undecided about or sceptical of climate change. Similarly, Rothermich, Johnson, Griffith and Beingolea (2021) found that adults exhibiting openness traits were most likely to believe in climate change and perceive it as a risk.

3.9 Values - What is important

Learning about personality traits explains what people are generally like and how they differ, however, it seems just as critical to understanding what people consider important and what their values. While a particular value is significant to someone, it may not be important to someone else (Schwartz 2012, 3). A preference of different value-sets may motivate or hinder pro-environmental and climate-friendly action. Notably, pro-environmental behaviour has been often explained with the help of the Schwartz theory of basic values (Guagnano et al., 1995; Stern, 2000; Milfont et al. 2015; Boer & Fischer, 2013). Social psychologist Shalom H. Schwartz (1992) described ten universal and distinct values applicable worldwide (Schwartz 2012, 16). These are self-direction, stimulation, hedonism, achievement, power, security, conformity, tradition, benevolence and universalisms.

Each value is underlined by a specific goal. For example, the defining goal of power is “social status and prestige, control or dominance over people and resources” (Schwartz 2012, 5), while universalism is motivated by “understanding, appreciation, tolerance, and protection for the welfare of all people and for nature” (Schwartz 2012, 7). These basic values are dynamic. They interact with each other and may support but also be in conflict. For example, Schwartz (2012, 8) explains how “pursuing achievement values typically conflicts with pursuing benevolence values. Seeking success for self

tends to obstruct actions aimed at enhancing the welfare of others who need one's help." To account for these conflicting value orientations, Schwartz organized these values along two bipolar dimensions and clustered the values into four groups: openness to change, conservation, self-enhancement, and self-transcendences. As figure 1 demonstrates, openness to change contrasts conservation values, whereas self-transcendence opposes self-enhancement values.

A significant body of research has associated self-transcendence values with greater pro-environmental orientation and found a negative correlation with self-enhancement values (Milfont et al. 2015; Boer & Fischer, 2013; Karp, 1996; Stern & Dietz, 1994; Stern, Dietz, Kalof, & Guagnano, 1995).

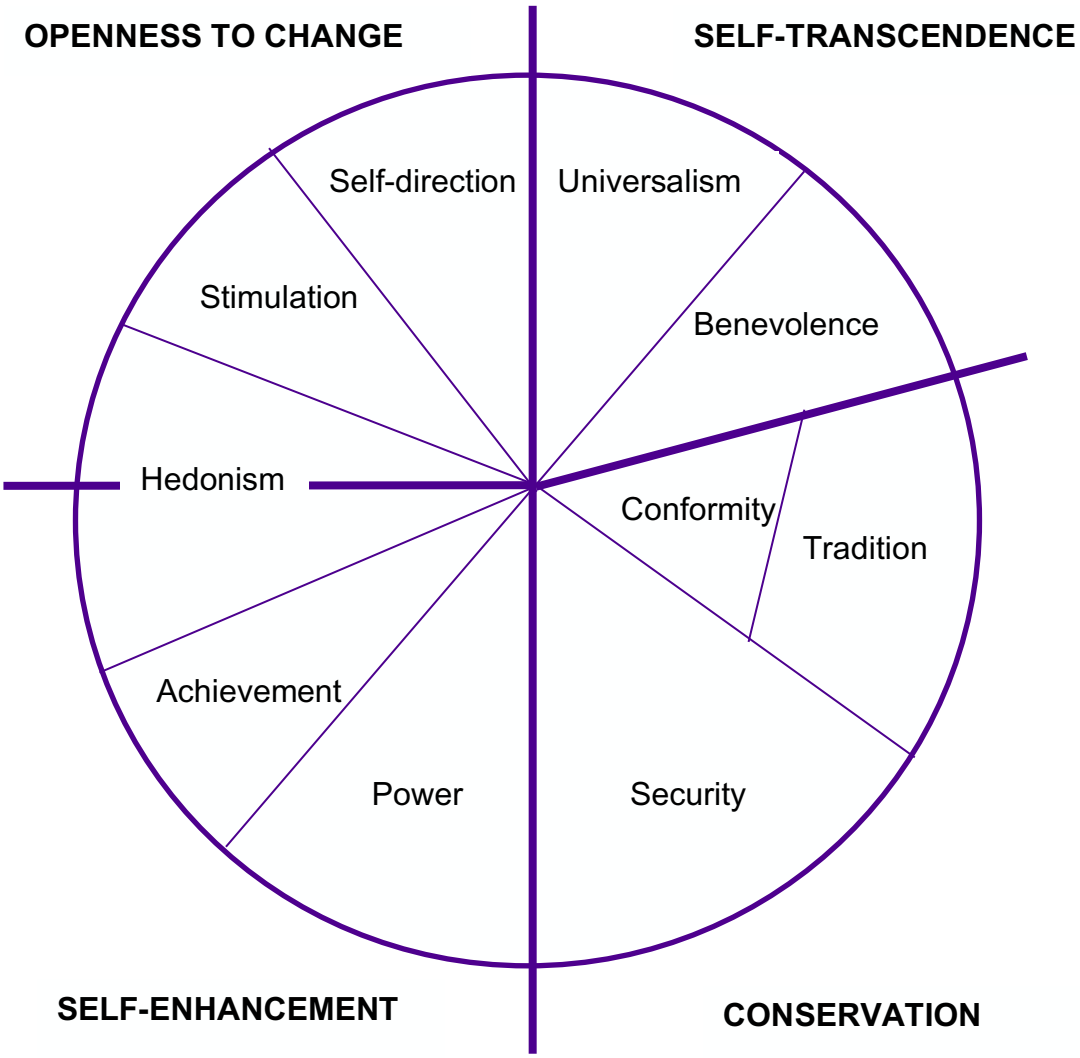

FIGURE 1. Theoretical model of relations among ten motivational types of value (Schwartz, 2000).

3.10 Norms – What is right and what is wrong

Shalom H. Schwartz proposed another crucial insight, the norm-activating theory (Schwartz 1972; Schwartz 1977; Schwartz and Davis, 1981), which sought to explain what motivates altruistic, including pro-environmental behaviour. The central elements are personal norms, in other words, feelings of personal obligations to act in a particular way (Smith & Kingston 2021, 53). According to this theory, helping behaviour emerges by activating personal moral norms, which occurs in response to two basic mechanisms. First, individuals believe certain actions to be a threat to others or the environment. In other words, they are aware of the negative consequences. The second prerequisite is understanding whether they can avoid or minimize these negative consequences and take responsibility for avoiding them. This mechanism is commonly referred to as the ascription of responsibility.

To illustrate the norm-activating theory, let us consider the following case study. Using leaded gasoline was standard practice in the 1970s USA, despite the early warnings on its adverse polluting and health effects (in fact, the US Environment Protection Agency completely phased out leaded fuel for road vehicles only in 1996). Heberlein and Black (1976) wondered what motivated those who bought lead-free gasoline. They found that lead-free buyers were more likely to hold a personal norm, influenced by the awareness of consequences (that leaded gasoline pollutes air), along with a sense of responsibility. Additionally, they perceived an informal social norm to buy lead-free.

Heberlein (2012, 101) encountered similar results when examining domestic energy savings, and he found that “awareness of consequences, feelings of responsibility, and measures of a perceived social norm led to a sense of personal obligation to use less energy.“ The role of these variables was further modelled and tested by Black, Stern and Elworth (1985), who highlighted the importance of personal norms in energy-saving behaviour.

3.11 Value belief norm theory

The norm-activating theory, value theory and the New Environmental Paradigm form an indivisible part of another influential model of environmental behaviour, the value-belief norm theory of environmentalism (Stern et al., 1999, Stern et al., 2000). Stern and colleagues extended the norm-activating theory by suggesting that for personal norms to be activated, individuals should perceive a threat to whatever object that they value (Stern et al. 2000, 413).

Biospheric or self-transcendent values underpin ones understanding and beliefs of the human-environment relations. Pro-environmental beliefs, represented through the New Ecological Paradigm, recognize the role of humans in perpetuating ecological crises. The awareness of the adverse consequences to valued objects, in this case, the environment, and perceiving a responsibility for action to minimize that threat activate a personal norm to act in a pro-environmental manner. The activated norm, finally, stimulates a predisposition to act (Stern, Dietz, Abel, Guagnano, Kalof 1999, 85). Animal-lovers, for example, be aware of the adverse consequences of the ecosystem and habitat destruction on animals and would be inclined to seek opportunities to mitigate these threats.

However, as models are generalizations of reality, Stern and colleagues (2000, 415) recognize how environmental action may also stem from non-environmental concern or that environmental intent may not necessarily lead to significant environmental impact. One could reduce resource-intensive behaviour not out of concern for the environment but out of the desire to save money. On the other hand, one may genuinely feel obliged to reduce resource-intensive behaviour but may fail to do so. For example, switching to non-renewable energy sources is impossible without a reliable grid, or switching to biking is complicated without quality cycling infrastructure.

Stern and colleagues also highlight how pro-environmental behaviour may decrease with increasing efforts or costs to perform it. The more complex, time-consuming or expensive a behaviour, the less like its adoption (Guagnano et al. 1995; Black et al., 1985; Stern et al., 1999). Therefore, a willingness to sacrifice is an essential element of pro-environmental or climate-friendly action. Put

simply, even if someone is concerned about anthropogenic climate change but is not willing to sacrifice time or resources in favour of lowering their carbon footprint, they may not act in a climate-friendly way (Smith & Kingston 2021, 53).

Despite potential limitations, the value-belief-norm theory has proved helpful in a great diversity of contexts, for example, in predicting climate mitigation and adaptation behaviours of Chinese rice farmers (Zhang, Ruiz-Menjivar, Luo, Liang & Swisher 2020), in examining energy conservation behaviour in Tunisia (Ibtissem, 2010), the acceptability of energy policies aimed at decreasing household CO2 emissions (Steg, Dreijerink & Abrahamse, 2005), or in foreseeing pro-environmental behaviour in Taiwan (Chen, 2014). Ghazali, Nguyen, Mutum and Yap (2019) extended the VBN by including the effect that social norms have on pro-environmental behaviours. Indeed, social norms, our shared understanding of what is right and what is wrong, are powerful motivators of pro-environmental behaviours among adults (Bamberg & Möser, 2017).

3.12 Theory of planned behaviour

Social norms also play a crucial part of the theory of planned behaviour, elaborated by social psychologist Icek Ajzen (1985, 1991). According to the theory of planned behaviour model, attitudes, norms, and perceived behavioural control mechanisms influence the intention to take action. The strength of this intention can predict whether action will be taken. An attitude reflects whether a person evaluates a particular action positively or negatively, while norms refer to existing social pressure around that action. For example, an intention to become a vegan is likely to emerge if an individual endorses a vegan lifestyle and veganism is accepted and practised in their community.

Additionally, one needs to consider various behavioural controls, explained as the “resources and opportunities available to an individual that will allow them to engage in a particular behaviour” (Smith & Kingston 2021, 49). To understand climate-friendly behaviour, we should consider ones’ perceived behavioural control, explained as the perception of how easy or difficult it would be to perform a task. Perceived behavioural control can also be associated with one’s self-

efficacy, the belief that one will be successful in accomplishing that action, and whether it will have the envisioned impact (Kollmuss & Agyeman, 2002). Heath and Gifford (2006, 64) also confirmed that “before individuals are ready to act against climate change, they must believe that even a small thing one individual can do will make a meaningful difference.” For example, adopting a vegan lifestyle may depend on believing in one’s ability to manage the transition from a non-vegan diet.

3.13 Self-efficacy and collective efficacy

The perceived self-efficacy of young people, or “the power of believing you can” (Maddux, 2012) deal with climate and environmental challenges plays a critical role in provoking action (Monroe & Li 2019; Buttgieg & Pace, 2013; Fieldings & Head 2012; Mead et al. 2012). Albert Bandura, who coined the term self-efficacy in 1977, and filmmaker Lynne Cherry, creator of the *Young Voices for the Planet* series explain that “unless people believe they can produce desired results by their actions, they have little incentive to act, or to persevere in the face of difficulties.” (Bandura and Cherry 2019, 948).

They illustrate collective self-efficacy in practice through a moving story of three nine-year-old Massachusetts girls who persuaded the Lexington town council to unanimously withdraw a law that prohibited solar panels on town buildings. “We had more power than we’d ever imagined in our wildest dreams” (Bandura and Cherry 2019, 948), told the girls after receiving a standing ovation at the town council. Their triumph or mastery experience cultivated their heightened sense of self-efficacy and motivated more action" “after that, it was like, we did that… what can we do no"?” (Bandura and Cherry 2019, 948). They convinced their school to install solar panels and saved a nearby forest.

The second source efficacy-beliefs, the so-called vicarious experiences (Bandura, Adams & Beyer 1977, 126), emerge from observing how role models, like peers, parents or teachers, cope with particular challenges. Note, for example, how climate activist Greta Thunberg became a role model who motivated millions of peers across the world to vocalize their concern. “Seeing

people similar to oneself succeed by perseverant effort also builds beliefs in their own capabilities", explain Bandura and Cherry (2019, 948).

Efficacy beliefs can further be reinforced by a third factor, social persuasion (Bandura, Adams and Beyer 1977, 126), which refers to a convincing verbal persuasion and encouragement, leading youth to believe" "they can cope successfully with what has overwhelmed them in the past." Importantly, to avoid potentially debilitating false expectations, social persuasion is advisable only if youth truly possess the skills and competencies to succeed (Tsang, Hui & Law 2011, 3).

The physiological and emotional state may also significantly influence one's perceived self-efficacy; this includes the "physical and mental readiness for action, vulnerability to fatigue, and susceptibility to a decision to continue or give up" (Tsang, Hui & Law 2011, 4). Hence, it is vital to consider how much youth worry, manage stress, or cope with adverse situations.

Psychologist James E. Maddux introduced an additional source of self-efficacy beliefs, referred to as imagined or imaginal experiences (2012). He suggested that self-efficacy beliefs can be influenced by "imagining ourselves or others behaving effectively or ineffectively in hypothetical situation." The influence of imagined experiences, however, is most likely not be as strong as an actual, lived experience would (Williams, 1995).

While self-efficacy is an important ingredient in motivating individual action, it is important to keep in mind that responding to climate change is a collective task (Busch, Ardoin, Gruehn & Steveson 2019; 2393). Naomi Klein (2019, 129) put it more bluntly, "the very idea that we, as atomized individuals, could play a significant part in stabilizing the planet's climate is objectively nuts." Engagement in pro-climate behaviour thus also depends on the closely related concept of collective efficacy.

Collective efficacy does not merely refer to the cumulative self-efficacy beliefs of multiple individuals but rather to the shared beliefs of individuals in a group's ability to reach the desired goals (Bandura 2000, 76). A perception of collective

efficacy, especially when aiming to tackle such a far-reaching problem as climate change, is critical in motivating individuals to take action (Jugert et al., 2016). As one young activist from the Young Voices for the Planet series note" “working as a team, it gives you much more courage than if you're working as an individual. If you are alone, it is always scary” (Bandura & Cherry 2019, 948).

Being part of an efficacious group can make one feel more capable and in control (Jugert et al., 2016). Jugert and colleagues (2016, 21) show how “these enhanced feelings of efficacy provide the ground for people to join in collective pro-climate action by tuning their individual everyday decisions to engage in pro-environmental behaviour.” Canadian journalist and climate justice activist Naomi Klein stirringly described group power in her commencement speech for the fresh graduates of College of the Atlantic. This college provides a degree in human ecology and is known for its strong community focus and environmental and social engagement. She said:

> “What you are doing is amazing. And what you will do next will be amazing, too. Because you are not alone. You are part of a movement. And that movement is organizing at the United Nations and running for office and getting their schools to divest and trying to block Arctic drilling in Congress and the courts. And on the open water. All at the same time. And, yes, we need to grow faster and do more. But the weight of the world is not on any one persons’ shoulders […] It rests in the strength of the project of transformation that millions are already a part of” (Klein 2019, 136).

The findings of this chapter regarding the motivating factors of climate action are put into perspective of climate change education through a visually appealing and coherent model of climate change education. Using the bicycle and cycling as a metaphor, Cantell, Tolppanen, Aarnio-Linnavuori and Lehtonen (2019, 718) emphasize how the bicycle requires all its parts to support each other to function well. However, a bicycle on its own is of no use. To meet its purpose, it needs someone who rides it. Similarly, climate change education emerges from the synergy of multiple elements, and it needs the learner to keep moving.

3.14 Wheels: Knowledge and thinking skills

The bicycle wheels refer to the knowledge and thinking skills on which climate change education is built (Cantell et al. 2019, 718-720). Knowledge should enable a basic understanding of the complexity of climate change. Nevertheless, the authors caution against knowledge accumulation as the aim of climate change education; instead, it should be considered as “a means to an end” (Cantell et al., 718). There are various interpretations of what elements constitute basic climate change knowledge. Taddicken, Reif and Hoppe (2018) distinguish between five types, dimensions of climate change knowledge.

The first type, causal knowledge, refers to a general awareness of the existence of climate change exists and that it is exacerbated by human activity (Taddicken et al. 2018, 4). Notwithstanding, being aware of climate change does not mean one can explain why it is happening. The second type, basic knowledge, entails an ability to understand basic climate science facts, while the third, effects knowledge, seeks to explain the impacts of climate change (Taddicken et al. 2018, 4). Subsequently, action-related knowledge includes how human action interacts with the climate, for example, regarding individual carbon footprint (Taddicken et al. 2018, 4). The final and fifth type, procedural knowledge, considers how knowledge is produced and includes an understanding of scientific processes and modes of inquiry (Nisbet 2002, 595). Taddicken and colleagues explain that procedural knowledge recognizes that results of climate science research could be incomplete and contradictory and that it “can never offer universally valid answers with a zero per cent error probability” (Taddicken et al. 2018, 5).

In 2009, the U.S. Global Change Research Program presented the Climate Literacy guide, articulating the essential principles for understanding the Earth’s climate. Following up on this guide, Shepardson, Niyogi, Rouychoudhury and Hirsch (2012) formulated the Climate Systems Framework, which includes six key domains that the authors consider critical in understanding the basic functioning of the climate system. These domains are natural causes and changes to the climate system, atmosphere and pollution, snow and ice levels, oceans (sea levels, temperatures, and life), land and vegetation, and human impact.

Others have approached the challenge of framing the climate basics from a more human-oriented perspective. For example, Andrey and Mortsch (2000) called for addressing (in)equality of how climate change disproportionally affects certain groups of people. Additionally, Schreiner, Henriksen, and Kirkeby Hansen (2005, 9) argued to explore climate change as a media issue, such as how media may "contribute to public doubt and confusion about the existence and the gravity of the problem." Schreiner and colleagues further suggest (2005, 9-10) that climate change education should also be made visible and consider how the impacts of climate change will manifest through short, or longer-term timescales. It should also address issues of responsibility, the ongoing tensions between environmental protection and political and economic interests, and the extent to which individual contributions to solving climate change are significant.

For knowledge to be useful, the authors of the bicycle model highlight that it should be critically evaluated and finds real-world application. This is why the two wheels of the bicycle are equally big (Cantell et al. 2019, 719). On top of that, learners should reflect on widely held values or the political and economic rationales behind the various responses to climate change. Cultivating critical and systems thinking, and ability to assess personal and societal values, face uncertainty and reflecting on future scenarios are thus a *conditio sin equa non* of climate change education (UNESCO 2017, 10; Cantell et al. 2019, 720; Lombardi, Sinatra & Nussbaum 2013; Roychoudhury et al. 2017, 73)

3.15 Frame: identity, values and worldview

Cantell and colleagues further suggest engaging with climate change through the lens of values since the learner's values can significantly affect any knowledge and skills acquired through climate change education. As shown on pages XYZ of this thesis, values are important factors that affect how individuals approach climate-related topics. However, values are not only significant on the individual level. "The wicked nature of climate change", the authors of the bicycle model remind us, "is reflected in conflicts of value "(Cantell et al. 2019, 721). Whereas the climate challenge humanity faces right now is solvable from a purely technical perspective, it is critical to ask, "what would it take for us to be solving the

technically solvable challenges "(Mike Berners-Lee as cited in Carver 2019). Using Berner-Lee's simile to illustrate this, at a point in time when 690 million people in the world are going hungry (FAO et al. 2020, xvi), ensuring global food and nutrition security boils down to the "staggeringly simple question of whether those of us who have plenty care sufficiently about those who don't have enough "(2019).

Learners should be encouraged to discuss how values shape their attitudes towards climate change and those most affected by it. They could also reflect on how self-transcendent values can manifest in real life. Berners-Lee (2019) suggests the cultivation of three essential values to overcome the ongoing crises. The first recognizes equality in that "all should be allowed, encouraged and enabled to live their lives in whatever way they find meaningful, provided this is negotiated alongside the equal rights of others to do likewise "(Berners-Lee 2019). The second value rests in respecting and caring for the world in all its beauty, complexity and diversity, while the third value consists of respect for truth (Berners-Lee, 2019). Deliberately designing activities through which learners engage with these values could provide an interesting opportunity to strengthen the bicycle's frame.

Additionally, Cantell and colleagues (2019, 720) recommend thinking about the learners' identity as consumers and perpetrators of environmental and social problems. These problems are often inextricably linked to resource-intensive lifestyles, and thus efforts to lower environmental impact entail changing longer-term habits and stepping out of our comfort zones. Hence it is worthwhile for learners to reflect on what habits and comforts they are willing to let go of.

3.16 Chains and pedals: action to curb climate change

Riding a bike can be rather demanding and require a lot of pedalling effort, especially when biking for a long time, uphill, on bumpy roads, or running into a headwind. In the bicycle model of climate change education, the chains and pedals refer to actions that the learner should take in real life. One must keep in mind that there are many kinds of climate action, which differ in their complexity,

resource, and time intensity, whether they are taken in the private or public sphere or to the extent that they mitigate climate change's adverse effects. These, in turn, influence how easy or hard will it be to ride the bike.

3.17 Saddle: motivation and participation

The biker-learner is more likely to use the bike it is comfortable to sit on, and when the saddle is compatible with the physique and flexibility of the rider. In the bicycle models' interpretation, the saddle represents the motivation of the learner. Motivation to engage with climate change grows with the relevance of the issue to the learner's life. Susanne C. Moser (2010, 40) advises that the "invisible causes and impacts must be made visible; the inconceivable solutions must be illustrated; perceived and real barriers to action must be shown as something 'people like me' have overcome." Thus, climate change education should be authentic to the lives of the learners while at the same time increase their self-efficacy.

Concerning motivation and participation, Cantell and colleagues (2019, 721) advocate for providing the learners opportunities to "participate in joint positive action." Learners should realize the importance, and benefits of working together in addressing climate change. The significance of collective efficacy, or the power of believing we can jointly make a difference, is explained on pages 39-40. Without a motivation to participate in a climate change education program, the learner's relationship with the subject can become bitter. As Arthurs-Brennan (2020) from the Cycling weekly explains, "the relationship between saddle and rider can very easily become a one way track for resentment."

3.18 Brakes: operational barriers

Along with understanding what motivates climate action, it is also important to discern what may hinder such action. For this reason, the breaks within the bicycle model account for the operational barriers that can stop the bike from moving. There are two broad categories of barriers. The first one refers to

structural obstacles, such has insufficient infrastructure a lack of resources. For example, living in colder regions increases the need for heating, and thus for energy consumption. Low-income households can hardly decrease the particulate matter pollution resulting from them burning solid fuels like coal and wood if they cannot afford alternatives (Baborska-Narozny et al. 2020).

Barriers to significant action may also be explained by a surprisingly rich variety of psychological and socio-cultural barriers (Cantell et al. 2019, 721; Milfont et al. 2015). For example, part XYZ of this thesis shows how political worldviews (Hornsey et al. 2016), support for free-market ideology (Heath & Gifford 2006) or endorsement of the New Ecological Paradigm (Dunlap et al. 2000), among others, may influence how one approaches environmental challenges. In 2011, environmental psychologist Robert Gifford presented twenty-nine psychological obstacles that block adequate climate action. He catchily refers to these obstacles as the dragons of inaction. Gifford classified seven genera of dragons, from limited cognition such as judgemental discounting through which humans undervalue future risks (Gifford 2011, 292), to limited behaviours like tokenism, being satisfied with easy and low impact action (Gifford 2011, 296).

3.19 Lamp: hope and other emotions

The scale, complexity and severity of climate change can be quick in disempowering and disengaging learners. Without exaggerating, the foreseen doom and gloom consequences of climate change are scary, especially when coupled with a perception that nothing is being done about it. In addition to affecting ecosystems worldwide, climate change has profound psychological effects and young people, in a critical period of their physical and psychological development, are especially vulnerable to elevated levels of stress and anxiety (Wu, Snell & Samji 2020, e435; Clayton 2020, 102263).

In their Lancet commentary, Wu, Snell and Samji (2020, e435) explained how climate anxiety “during a crucial developmental period, coupled with an increased likelihood of encountering repeated stressors related to climate change throughout life, will conceivably increase the incidence of mental illness over the

life course.“ Climate change is now linked with many mental health responses, such as anxiety (Clayton 2020; Pikhala 2019), grief (Cunsolo et al. 2020; Cunsolo & Ellis 2018), frustration or anger (Stanley, Hogg, Leviston & Walker 2021), hopelessness or despair (Pearl, 2019).

The lamp in the bicycle refers to hope and other emotions, which sheds light on the way to move forward, helping to overcome the unpleasant and potentially debilitating effects of climate anxiety (Cantell et al. 2019, 721). Maria Ojala offers valuable advice on how to turn on the light. She reminds us that coping with climate-related emotions is a social process and how educators should be attentive to how they respond and what sorts of norms they reinforce within the learning environment (Ojala 2016a, 344). For example, disregarding learners worries provides “a strong signal about the worth of their emotions“ (Ojala 2016a, 344).

Instead, Ojala (2013; 2016) encourages bringing these worries to the surface and critically discussing them. “To evoke hope,“ Ojala (2016b, 51) suggests showing “that things can change,“ for example, by presenting inspiring individuals and groups that “transgress unsustainable norms in diverse ways.“ Getting to know active people and building trust in them is also an important component of trust (Ojala, 2012). Furthermore, hope can grow through positive re-appraisal, which entails an ability to “reverse one’s perspective“ of threatening events and activates “positive emotions that can help one to face the difficult situation and deal with worry constructively“(Ojala 2012, 636).

Learners should also be encouraged to participate in activities that mitigate the impacts of climate change (Clayton 2020, 5) and consider engaging in climate collective climate action, for these prove to reduce negative emotions. Bamberg, Rees and Schulte (2018, 208) present evidence that participating in collective action fosters “feelings of social connectedness, empowerment, and efficacy“ while at the same time “nurture the conviction that change is possible.“

3.20 Handlebar: future orientation

Ojala (2021, 2016b) further suggests that hope can emerge through futures-thinking, which leads us to the final component of the bicycle, the handlebar (Cantell et al. 721-722). Learners should direct the bike's handlebar towards the future, reflecting on "probable, preferable, and possible futures"(Ojala 2016b, 51). They should have opportunities to reflect on what kinds of futures they wish for while recognizing that their visions of the future may clash with the visions of others. These envisioned futures should be contrasted with how the future is likely to turn out based on current trajectories, that is if society carries on with business as usual. In attempts to avoid unrealistic hope, Ojala (2016b, 52) advises to imagine visions of future that are grounded in reality and design "pathways (both societal and individual) to this possible future and to promote agency, so that young people can take part actively in these pathways."

4 METHODOLOGY

4.1 Overview of the Delphi method

In 1970 (1009), Turoff outlined four research objectives that call for using the Delphi technique. Two of these, correlating informed judgements on a topic spanning a wide range of disciplines and seeking information to generate a consensus within a respondent group, align with agreeing on the learning objectives on such a complex theme as climate change. In short, the Delphi technique is “designed as a group communication process which aims to achieve a convergence of opinion on a specific real-world issue“ (Hsu & Sandford, 2007, 1). Miller (2006) further explains that while common surveys try to identify “what is,” the Delphi method attempts to address “what could, or what should be.”

The method relies on a group of selected professional or experience-based experts who anonymously participate in multiple rounds of questionnaire surveys. The first round begins with an open-ended questionnaire aimed to gather information about the theme of the study. The answers from the first round are thematically analysed and form the basis of the second questionnaire. This questionnaire is well structured, and the expert panel is asked to “rate or rank-order” (Hsu&Sandford 2007, 2) the importance of the items which emerged from the thematic analysis. The results of the second round should expose divergence or convergence of opinions amongst the experts.

In the third round, the research summarises the previous round to the expert panel, generally as a statistical representation of the groups’ response. This statistical feedback helps experts see where their individual opinions stand when compared with the group average (Hasson et al. 2000, 1012). The third survey identifies items for which the group has reached consensus. The expert group is then asked to rate or rank-order those items for which consensus has not yet been reached. The analysis of the third round reveals whether the panel has reached a consensus on the remaining items. If so, the Delphi process is finalised. If not, successive rounds are implemented until a consensus is reached.

The Delphi method is believed to have multiple benefits over other, face-to-face group communication efforts (von der Gracht 2012, 1526). First of all, the anonymity of the process ensures that every participant has the same opportunity to express views as dominant speakers don't overtake the group discussion (Fischer 1978). Being anonymous, they are not under peer pressure, and respondents are more likely to express unconventional ideas (Strauss & Zeigler, 1975).

The RAND Corporation developed the method in the mid-1950s to foresee how technology would impact future warfare. Seven decades later, the technique has been used in a diversity of cases, and there are many well-documented instances for its use in curriculum design. For example, Sitlington and Coetzer (2014) used the technique for curriculum renewal in strategic human resource management to ensure industry relevance of the learning content, while Danju and Islek (2018) used it to determine the learning objectives of a global citizenship education curriculum. Chang Rundgren and Rundgren (2016) engaged 100 stakeholders in a Delphi study to reach a consensus on enhancing civic scientific literacy.

Several studies describe the application of the Delphi technique within the field of environmental or sustainability education. Seo, Ryue and Hwang (2020) adopted it to determine key competence indicators in environmental education for South Korea's secondary school curriculum. Wright and Defields (2012) used the Delphi method to reach a consensus between the core faculty members of Dalhousie University in Canada on the essentials of an undergraduate sustainability program (Wright & Defields 2012). Addressing the lack of agreement on what medical students should learn about environmental sustainability in the UK, Walpole and colleagues (2015) used the technique to determine learning objectives for undergraduate and postgraduate levels. Researchers Vallor, Yates and Brody (2016) used the Delphi technique to establish key foundational knowledge, skills, and attitudes for a place-based watershed education program in Montana, USA.

4.2 Sample selection

The experts invited to participate in the Delphi process were identified through non-probability sampling, specifically purposive sampling. As Polit and Hungler (1997, 229) explain, purposive sampling is employed under "the assumption that a researcher's knowledge about the population can be used to handpick the cases to be included in the sample." Within the context of this Delphi study, the researcher's knowledge and understanding of the environmental and climate change education context is given by her former professional experience in the public policy-level governance of environmental education and her current active involvement with non-governmental environmental and climate change education initiatives.

Given that addressing climate change through education is a complex challenge, the goal was to assemble a diverse expert panel that could provide "both depth and breadth of the multiple perspectives on the issues" (Nworie 2011, 25). For this reason, the researcher invited scientists, non-formal educators experienced in climate change education, governmental and non-governmental representatives, sustainability managers, and a member of the local youth climate movement to participate in the Delphi process. While there are no exact criteria on the size of a Delphi panel, Okoli and Pawlowski (2004, 18) recommend the panel should be composed of 10-18 experts and Ludwig (1997, 2) found that most Delphi studies "used between 15 and 20 respondents." In total, 22 experts were approached, out of which 17 agreed to become part of the expert panel.

TABLE 3. Composition of the Delphi panel.

Expert 1	Environmental educator and eco-center leader of more.
Expert 2	Award-winning climate change communication initiative.
Expert 3	Representative of the youth climate movement.
Expert 4	Environmental organization representative, climate change education analyst.
Expert 5	Sustainability management expert.
Expert 6	Climate policy expert, representative of the public sector.
Expert 7	Climatologist

Expert 8	Impact manager, Thesis commissioner
Expert 9	Climate adaptation analyst.
Expert 10	Lead of a university sustainability management centre.
Expert 11	Environmental policy analyst, recent research focus on formal education system.
Expert 12	Environmental educator, coordinator of a climate change education working group.
Expert 13	Foresight specialist of the Academy of sciences.
Expert 14	Climate change education researcher.
Expert 15	Impact investor.
Expert 16	Environmental educator, coordinator non-formal environmental education providers
Expert 17	Environmental educator, eco-center leader, teacher-trainer.

4.3 Overview of the first round of the Delphi process

The first survey, along with an informed consent form, was sent out on March 3, 2021. The experts were informed via email and the survey was conducted via SurveyMonkey online tool. The expert panel was informed about the objectives, the format, and the schedule of the Delphi study. The survey was implemented in the Slovak language, and the respondents had a week to complete it.

The first round of a Delphi study can generally be conducted in two ways. In some studies, the experts receive a structured questionnaire and are asked to rate specific propositions developed by the researcher based on an extensive literature review. This approach has been favoured to save time, maintain participation levels, or "avoid unnecessary attrition" (Sitlington & Coetzer 2014, 311). The second approach is to ask open-ended questions, which, as Hasson suggests (2000, 1011), allow for "complete freedom" in expert responses.

The open-ended format may also reduce "the chances of excluding items that the research may have omitted" (Nworie 2011, 26). Hasson (2000, 1012) further warns that structured questionnaires may "bias the responses or limit the

available options." With this caution in mind, the first survey was made up of three open-ended questions, namely:

1. What should a young person know to effectively and proactively tackle the climate crisis?
2. What should a young person be able to do to effectively and proactively tackle the climate crisis?
3. What kinds of values and attitudes are indispensable to effectively and proactively tackle the climate crisis?

These three questions essentially encompassed the cognitive, psychomotor and affective learning domains addressed by Bloom and his colleagues (1956) and Sipos, Battisti and Grimm's (2007) transformative sustainability learning which engages head, hands and heart. The response rate of the first survey was 94%, with 16 experts completing the survey.

4.4 Thematic analysis of the first round

The responses to the open-ended questions were closely examined through thematic analysis, which, as Lisa M. Given (2008) explains is "data reduction and analysis strategy by which qualitative data are segmented, categorized, summarized, and reconstructed in a way that captures the important concepts within the data set." The researcher followed the six-step thematic analysis process as proposed by Braun and Clarke (2013).

The first step is getting familiar with the data. All the responses were exported to a word document, resulting in 22 pages and a total of 5780 words. The responses had been carefully read and reread before moving onto the second step, coding. Braun and Clarke (2013, 207) explain that "a code is a word or brief phrase that captures the essence of why you think a particular bit of data may be useful." A semantic focus to coding was selected, which highlights "explicitly-stated ideas, concepts, meanings and experiences" (Braun, Clarke & Weate 2016). The coding was done in Microsoft Word in line with the coding format presented by Damayanthi (2019). Relevant parts of the text were highlighted in colours, which

corresponded to particular codes. The codes were simultaneously summarized at the page margins.

The third step, theme development, involved “clustering codes to identify higher-level patterns” (Braun et al. 2016, 10). The themes were identified inductively, that is, the data itself determined the themes (Caulfield 2019), as opposed to the deductive approach, that would search “for themes in the data that fit an existing theory, theoretical framework, or typology” (Allen, 2007).

These draft themes were then reviewed and against the original dataset as per Braun and colleagues’(2016, 12) suggestions. Well-conceptualized themes have a central organizing concept, are distinct from each other, and tell a "coherent and compelling story of the data that address the research question" (Braun et al. 2016, 12). The following section presents the outcome of the fifth thematic analysis step, defining and naming themes, and the final, sixth step, writing up the results. What story did the dataset tell? It revealed fifteen themes and ninety-three subthemes. The reader should note that these themes would be further refined through the Delphi process's subsequent rounds, insights from expert interviews, and academic literature.

Theme 1 – Mechanisms of climate change entails what the learner should know about the climate system's functioning, which includes understanding the difference between climate and the weather, carbon cycle, greenhouse gases and the greenhouse effect and the dominant effect of CO2 on climate change. The learner should also know how the climate affects life in different places on earth and explain common misconceptions around scientific facts, such as "the tendency to confuse the depletion of the ozone layer with climate change," as one respondent explained.

Theme 2 – Climate change causes presents issues that contribute to climate change and barriers to effective action, which essentially enhance the adverse impact of these causes. The learner should understand the deep social roots of climate change, such as the dominant anthropocentric western worldview that governs most of our lives. In the words of one of the respondents, "a young person should know, that in our dominant western culture we are looking at the

world, and its processes, through particular lenses, which affect what we perceive as valuable. In Czechia and Slovakia, we mostly look at the world through the prism of economic growth, the main indicator being GDP. It important to know that this is only one viewpoint which is not all-encompassing." In line with this suggestion, the expert panel believes in the importance of clarifying capitalism's role in the climate crisis, including the problem of exponential growth in a limited space. The learner should also understand how population growth contributes to climate change. The causes above should not be taught in isolation; the learner should understand their interconnectedness. Regarding barriers, they should understand why some powerful groups are blocking climate mitigation efforts. Finally, the learner should also be aware of various psychological barriers that hinder effective climate engagement.

Theme 3 – Climate justice deals with the inequitable outcomes of climate change on various groups and fair and just solutions to this challenge. The learner should understand how the climate crisis deepens global inequalities, including climate migration or the differing carbon debt of developed and developing countries. The climate justice perspective should also highlight the intersection of social, gender and intergenerational (in)justices. Understanding these issues should empower the learner to argue for climate justice from a Slovak or a Czech perspective and become an advocate for justice in practice.

Theme 4 – Climate impacts encompass the manifold manifestations of climate change. The learners should understand how the planet is warming at different rates in different places, or, for example, as one expert pointed out, “over the past sixty years, the planet has warmed by 1,2°C on average, while Czechia has warmed by 2°C. Some places are warming up four times faster than the planetary average.” Hence, the learner should understand how climate change manifests globally and in the Czech and Slovak contexts. They should also understand the tipping points of the climate system “where a changing climate could push parts of the Earth system into abrupt or irreversible change“ (Mcsweeney 2020). As climate change affects the whole earth system and all aspects of society, the learners should understand its impacts on biodiversity, food security, health, social cohesion, political stability, culture, and economy.

Theme 5 – Climate solutions includes diverse approaches for addressing the climate crisis. It starts with an understanding that solutions for a low carbon economy are not a threat but a development opportunity. The learner should understand that climate solutions already exist from a technological perspective but should be applied at a sufficient scale. The learner should explore solutions through multiple lenses; she/he should understand both individual and collective solutions, technological and logistical solutions and sectoral solutions, particularly in the fields of energy, electrification of transport and heating, resilient landscaping and agriculture.

Furthermore, the learner should be able to distinguish between adaptation and mitigation measures. Notably, the learner should be able to evaluate the impact of these solutions and, as two experts elaborated, discern "cosmetic measures from systems solutions" while advocating for solutions "that do not undermine each other." This could include understanding the so-called Jevons paradox, according to which an increase in efficiency can paradoxically lead to a rise in overall consumption.

Theme 6 – Politics highlights the political dimension of the climate crises. The experts call for an understanding of how policy decisions, including legislative and regulatory frameworks, impact climate protection. The learner should know about strategic and policy frameworks, agreements, objectives and commitments at the national, EU and global level, such as the Paris Agreement. Understanding the policy landscape entails a basic comprehension of how political power and decision are established from local to global scales. The learner should also have a good overview of available political and apolitical platforms that advocate for climate protection. Those young people, who are at the age to vote, should vote for politicians who can address the problem. In line with this, they should demand effective climate action from elected representatives.

Theme 7 – Citizenship underlines the role of active citizenship in climate action. The learners should be aware of her/his civil rights and knows how to use them purposefully for climate action. On top of that, the learner understands the importance of integrating youth voices into the global governance of climate protection and can lobby for it across various levels.

Theme 8 – Time scale refers to the need to understand the past, present and future dimensions of climate change. One respondent advocated for “educating youth for the future and not from the past” yet deemed it essential to recognize the historical context and extent of climate change in the past. The learner should understand that climate change is not a remote, abstract risk, and thus it needs to be addressed today. The learners should comprehend time-related concepts, such as peak-oil, a hypothetical point when global crude oil production will hit maximum, after which it will start declining (Kenton 2020). Another such concept is the carbon budget, the amount of CO2 emissions that human activities should emit to keep global warming within a safe threshold (Sussams 2018). Regarding the future, the learner should have a basic understanding of the global megatrends, which, as the European Environment Agency (2021) explains, are “great forces that are likely to affect the future in all areas throughout the world over the next 10 to 15 years.” Last but not least, she/he should understand various climate change scenarios and project the impacts of ambitious climate action.

Theme 9 – Information and media literacy highlights the need for informed judgment when working with information and media sources. The learners should understand the need for verified and reliable data when learning and talking about climate change. They should be able to evaluate the relevance and correctness of the information they encounter and identify hoaxes. As one respondent noted, they should be able to “ask the right questions” when learning about climate change.

Theme 10 – Communication entails the skills and dispositions that the learners should have when talking about climate change with others. They should communicate effectively with different target groups and varied context about climate change, which includes honesty and avoiding unnecessary polarization. In the words of the respondents, they should “help to develop the climate literacy of others”, “communicate basic climate knowledge without pathos and exaggerated emotions”, and “skillfully and promptly argue and communicate about the climate crisis with their communities.” Since communicating about this

topic can often be challenging yet meaningful, they should not be afraid of unpleasant discussions.

Theme 11 – Thinking skills include cognitive skills that the experts consider crucial to address the climate crisis effectively. The learners should become critical, systems, strategical and solution-oriented thinkers. They should also cultivate a growth mindset, which, as one respondent explained, helps “perceive situations as opportunities for personal growth and development.”

Theme 12 – Sustainable and low-carbon lifestyle revolves around actions and principles the learners should adopt in their everyday lives. They should evaluate how their day-to-day activities contribute to climate change, for example, by calculating their carbon, environmental, or climate footprint, the energy consumption of their households, and consider the life-cycle impact of the products they use. They should act on these finding and purposefully lower their impact on the climate. One of the ways could be minimizing waste prevention, or in the words of the respondents, “considering the carbon footprint of investments whenever they use their money” and knowing “what environmental and ethical standards to demand from the companies from whom they purchase.” Several respondents advocated for the adoption of voluntary modesty by “evaluating own desires and needs”, “being able to deny comfortable solutions in favour of climate protection”, or by “being modest, especially in terms of material goods, but also climate-intensive experiences.”

Theme 13 – Engagement and initiative underline personal agency in practically addressing the climate crisis. The learner should be empowered to change things for the better, lead others by example, and work to gain broad societal support for climate action. They should be willing to commit time to address climate change, network with like-minded groups, collaborate with others, or consider employment within the context of climate change.

Theme 14 – Mental health deals with the need to actively address mental health issues, which may arise from engaging with the often-overwhelming challenge of climate change. Young people should be able to care for their mental health, for example, as one respondent explains by understanding that “addressing the

climate crisis is a collective task, not a burden she/he should carry alone." They should be able to share their feelings regarding climate change and create a support system made up of people who care about them and for the cause of climate protection.

Theme 15 – Values and attitudes includes the values and attitudes the expert deemed necessary when addressing the climate crisis. The learners should be empathic and solidary with others who are in vulnerable and disadvantaged positions. They should be honourable and accept their responsibility for the climate crisis. Developing a deep relationship with nature was also listed as indispensable by several respondents. Respecting diversity is also amongst preferred values, described by one respondent as "the respect for diverse identities, voices, abilities and cultural wisdom." A young climate change agent should be curious and continuously learn about "what is happening on the global, local, civic and scientific scene." Some experts also highlighted the need for patience and perseverance, bravery "in thinking, opinions and behavior" or consistency in "opinions, attitudes and action to be accountable and not live in an ivory tower." Finally, the learner should be resilient to political, social and climate conditions and capable of coping with extreme situations.

4.5 Overview of the second round of the Delphi process

The second questionnaire was sent out on March 15, 2021, asking the respondents to rate the importance of the ninety-three subthemes identified in Round 1 through a five-point Likert scale (1= very important, 2= rather important, 3= undecided, 4= rather unimportant, 5= unimportant). Additionally, the experts were provided with a voluntary opportunity to comment on their rating, or on the formulation of the subtheme. The response rate of the second survey was 100%.

The reliability of the survey was calculated measuring the internal consistency of the answers using Cronbach's alpha. The Cronbach's alpha equalled 0.95. According to the popular advice of George and Mallery (2003, 231), Cronbach's alpha should be interpreted in the following way: "≥ .9 – Excellent, ≥ .8 – Good, ≥ .7 – Acceptable, ≥ .6 – Questionable, ≥ .5 – Poor, and ≤ .5 – Unacceptable."

However, Tavakol and Dennick (2011) point out that a high alpha level, one greater 0.9, may indicate redundance, or the lengthiness of a survey and this interpretation may hold true for the present survey of 93 items. According to Jum C. Nunally (1978, 226) and with Robert W. Kaplan and Dennis P. Saccuzzo (1982, 106), however, a Cronbach's alpha of 0.95 is the recommended reliability level for applied research.

4.6 Determining consensus

There is no widespread agreement on the definition of consensus within Delphi studies (Hsu & Sandford 2007; Giannarou & Zervas 2014; von der Gracht 2012). Consensus, according to von der Gracht (2012, 1528), "is one the most contentious components of the Delphi method, and its measurement greatly varies." Some studies declare consensus by a predefined percentage of agreement, for example, by having more than 80% of respondents voting desirable or undesirable on a 5-point Likert scale (Putnam, Spiegel, Bruininks, 1995, 14).

Others prefer using central tendency measures, such as the mean, median or mode, along with the level dispersion, measured through standard deviation or the interquartile range. However, von der Gracht (2012, 1530) cautions against the application of the mean, as it is not a suitable measurement for ordinal scales, like the Likert scale used in the second survey.

Using the interquartile range (IQR) is considered as an "objective and rigorous way" of determining consensus" (von der Gracht 2012, 1531; Rayens & Hahn 2000, 314). Miriam Raskin (1994, page number is not available in the electronic publication) suggests that an IQR of 1 or less is usually a suitable consensus indicator for 4- or 5-unit scales. Murphy and colleagues (1998, 57) recommend using the median and IQR as these measures have "the advantage of robustness in the sense of being independent of each extreme value and less sensitive to skew in the distribution of responses. "

For the purposes of the second round of the Delphi study, consensus on a particular subtheme was determined by the combination of the following criteria:

- No expert rated the subtheme as “rather unimportant“ or “unimportant“
- The interquartile range was between 0-1
- The median was 1, corresponding with the “very important“ rating
- The mode was 1, corresponding with the “very important“ rating

The consensus criteria were deliberately kept strict, meaning that even one negative evaluation could lead to the reconsideration of said item in the final Delphi round. Negative ratings were given the benefit of the doubt. On top of that, considering the many comments provided, the expert panel also received a chance to reevaluate items, which were mostly rated as rather important.

Evaluating against the above-mentioned criteria, forty-eight items did not reach consensus. Table 4 presents the results of the second round of the Delphi study. Elements listed in cursive present the contentious items which were carried over to third round. The remaining consensus items were categorized as high-priority items, which will definitely be reflected within the learning goals for the climate change education program. It is important to highlight that no items was rated as unimportant.

TABLE 4. Results of the second round of the Delphi study arranged according to themes.

ITEM	IQR	MODE	MED.	Important + Very important
CLIMATE CHANGE BASICS				
Climate systems basics	1	1	1	100%
Climate change affects life on earth	1	1	1	100%
Carbon cycle, greenhouse gases and effect	1	1	1	100%
Common conceptual misunderstandings of climate change	*1*	*2*	*2*	*82%*
CLIMATE CHANGE CAUSES				

Warming of the planet is proportionate to cumulative emissions	1	1	1	100%
Deep social roots of climate change anthropocentrism)	1	1	1	94%
The dominant economic system's role in driving climate change	1	1	1	94%
The contribution of population growth to climate change	*1*	*2*	*2*	*82%*
Powerful groups block climate mitigation efforts	*1*	*1*	*2*	*88%*
Psychological barriers hinder effective climate engagement	*2*	*1*	*2*	*76%*
CLIMATE JUSTICE				
Interconnectedness of climate change causes	1	1	1	100%
Energy and climate poverty	*1*	*2*	*2*	*88%*
Deepening inequalities, including climate migration and the differing carbon debt of countries	*1*	*1*	*1*	*94%*
Intersectionality of climate with issues of social, gender and intergenerational justice	1	2	2	82%
Climate justice from a local perspective	*1*	*1*	*1*	*82%*
Advocating for justice in practice	*1*	*1*	*1*	*88%*
CLIMATE CHANGE IMPACTS				
Planet is warming at different rates in different places	*1*	*2*	*2*	*94%*
Climate tipping points	*1*	*1*	*1*	*94%*
Global and local manifestations of climate change	1	1	1	100%
Climate change impacts on the individual and society at large	1	1	1	94%
Climate change impacts on biodiversity	1	1	1	88%
Climate change impacts on food security	1	1	1	94%
Climate change impacts on health	1	1	1	94%

Climate change impacts on social cohesion and political stability	*1*	*1*	*1*	*88%*
Climate change impacts on culture	*1*	*1*	*1*	*94%*
Climate change impacts on the economy	1	2	2	71%
CLIMATE CHANGE SOLUTIONS				
Existence of solutions (solutions are known, however, they need to be implemented at sufficient scales)	*1*	*2*	*2*	*82%*
Climate neutral transitions are an opportunity, not a threat	1	1	1	94%
Local solutions for a global problem	1	1	1	94%
Individual and collective solutions	1	1	1	100%
Adaptation and mitigation solutions	0	1	1	100%
Economic solutions (self-sufficiency, local economies, decentralization, alternative systems)	*1*	*2*	*2*	*94%*
Societal transformation	1	1	1	94%
Technological and logistic solutions	*0*	*2*	*2*	*76%*
Sectoral solutions (energy, transport, heating and cooling, agriculture)	1	2	2	88%
Evaluate the efficiency and impact of these solutions	*1*	*2*	*2*	*88%*
Distinguishing between "cosmetic" and systemic, structural solutions	1	1	1	88%
Jevons paradox - increase in efficiency can lead to an increase in overall consumption	*1*	*1*	*2*	*82%*
POLICY AND POLITICS				
Impact of policy, regulation and legislation on climate change	1	1	1	100%
The establishment of political power and decision making	1	1	1	88%
Strategic and policy frameworks, agreements at various levels (IPCC, Paris Agreement, EU Green Deal)	*0*	*2*	*2*	*76%*

Overview of political and apolitical platforms that support climate action	*1*	*2*	*2*	*82%*
Support for political platforms that have climate within their priorities	*2*	*1*	*2*	*53%*
Demanding effective climate action from elected politicians	0	1	1	100%
CITIZENSHIP				
Citizenship and civil rights for climate protection	0	1	1	100%
Strengthening the voice of youth in search for solutions	1	1	1	100%
Exert pressure and lobby for climate protection at various levels	0	1	1	94%
TEMPORAL SCALES				
Historical context and extent of climate change in the past	*0*	*2*	*2*	*76%*
Climate change as a current challenge (not abstract, remote and to be addressed in the future)	0	1	1	100%
Peak oil	*1*	*2*	*2*	*59%*
Carbon budget	*1*	*2*	*2*	*88%*
Global megatrends	*1*	*2*	*2*	*82%*
Climate scenarios	1	1	1	94%
THINKING SKILLS				
Critical thinking	0	1	1	100%
Systems thinking	0	1	1	100%
Strategic thinking	1	1	1	94%
Solutions-oriented thinking	0	1	1	100%
Growth mindset	1	1	1	82%
INFORMATION AND MEDIA LITERACY				
Value of verified and reliable data	0	1	1	100%
Evaluating the relevance and correctness of the information	0	1	1	100%

Asking the right questions	1	1	1	100%
COMMUNICATION				
Initiating debate on climate change in diverse contexts	*2*	*1*	*2*	*71%*
Not being afraid of unpleasant discussions	*1*	*1*	*2*	*82%*
Effective communication with different target groups	*1*	*1*	*2*	*82%*
Honest communication without polarization	1	1	1	82%
LIFESTYLES				
Evaluates the impact of own activities on climate change	1	1	1	94%
Climate change information is applied to everyday activities	1	1	1	94%
Conscious consumerism	1	1	1	100%
Waste prevention	*1*	*2*	*2*	*94%*
Voluntary modesty	*1*	*1*	*2*	*76%*
ENGAGEMENT AND INITIATIVE				
Realizing the capacity to change things for the better	0	1	1	94%
Leading by example	1	1	1	88%
Applying for wide societal support for addressing climate change	*1*	*2*	*2*	*82%*
Willing to commit to climate issues	*1*	*2*	*2*	*88%*
Networks with like-minded individuals	1	2	2	88%
Collaborative problem solving	1	1	1	100%
Considers employment within the context of climate change	*2*	*3*	*2*	*53%*
MENTAL HEALTH CARE				
Mental health care	1	1	1	100%
Capacity to share emotions regarding climate change	*2*	*1*	*2*	*65%*
Creating a support system	1	1	1	82%
VALUES AND DISPOSITIONS				

Empathy	1	1	1	94%
Solidarity	1	1	2	94%
Deep relationship with nature	*1*	*2*	*2*	*94%*
Accepting responsibility of the state of the world	1	1	1	100%
Honor	1	1	1	76%
Continuous learning	*1*	*2*	*2*	*71%*
Respecting diversity and questioning stereotypes	*1*	*2*	*2*	*88%*
Ability to make compromises	*2*	*2*	*2*	*71%*
Perseverance and patience	*1*	*1*	*2*	*82%*
Bravery	*2*	*2*	*2*	*71%*
Consistency in thought and action	*2*	*2*	*2*	*65%*
Resiliency in face of change and adverse conditions	*1*	*1*	*2*	*76%*

Three additional items emerged from the commentaries of the experts, who suggested that rather than focusing on the impact of population growth on climate change, it is more important to consider the unequal carbon emissions of certain countries or income groups.

One item, pertaining to economic solutions, such as self-sufficiency, local economies, decentralization, and alternative systems, was called out for being poorly formulated. Thus, this item was elaborated and divided into three separate items for the third round to the Delphi study. The first of these rephrased items specified that by economic solutions we mean measures like carbon pricing, carbon tax, or non-financial reporting. The second represents alternative economic concepts such as degrowth or the doughnut economy. Measures such as self-sufficiency and decentralized solutions, were renamed as local and decentralized approaches.

4.7 Overview of the third round of the Delphi process

At the outset of the third and final Delphi round, each expert received a personalized report which summarized the results of the previous round. The report described how consensus was measures, provided an overview of the expert panel's opinion on each subtheme, along with their accompanying anonymized comments. The report reminded experts of their individual rating, the mode (most common rating of the group), median (central measure), IQR and information on the number of "rather unimportant" or "unimportant" ratings for each item from the second questionnaire.

Aware of the results of the second round, the expert panel was asked to reevaluate the elements which were not categorized as of high priority. Nonetheless, if an expert wished to reevaluate a high-priority item, they were also provided with the opportunity to do that. The third questionnaire was filled out by 15 experts, which means the response rate was 88%. According to Giannarou and Zervas (2014, 77), a response rate above 70% is acceptable in Delphi studies. The Cronbach's alpha for the third survey, like in the second survey, was 0,95.

One expert withdrew from the third round because of language barriers. The whole Delphi process was conducted in the Slovak language and was distributed amongst Slovak and Czech speakers. Speakers of these two languages generally understand each other; however, this expert, a non-native Czech speaker, had encountered difficulties with the more technical terminology.

For the purposes of the final round, high-priority items were defined as having an IQR between 0-1, while simultaneously having a median and mode equaling to one. That is, these items were typically rated as very important. A single "rather unimportant" or "unimportant" rating did no longer suffice to veto the priority of the item. The analysis of the third round revealed seventeen new high-priority items (Table 5). Thirty-three elements were categorized as of moderate priority (Table 6). These elements had an IQR of one, and the mode and median between 1-2. These most common rating for these elements was rather important. Items of

moderate priority would be given included in the climate change education program, however, with a comparably lower emphasis than high-priority items.

TABLE 5. High-priority elements resulting from the third round

ELEMENTS	IQR	MODE	MEDIAN	Important + Very important
Deep social roots of climate change	0,5	1	1	100%
Deepening inequalities, including climate migration and the differing carbon debt of countries	0,5	1	1	100%
Unequal carbon emissions of certain countries and income groups	1	1	1	93%
Climate justice from a local perspective	1	1	1	87%
Advocating for justice in practice	1	1	1	93%
Climate tipping points	1	1	1	93%
Climate change impacts on social cohesion and political stability	1	1	1	87%
Not being afraid of unpleasant discussions	1	1	1	87%
Honest communication without polarization	1	1	1	87%
Communicate climate change to diverse target groups	1	1	1	100%
Climate change information is applied to everyday activities	1	1	1	87%
Waste prevention	1	1	1	87%
Voluntary modesty	1	1	1	80%
Willingness to commit to climate issues	1	1	1	100%
Solidarity	1	1	1	100%
Perseverance and patience	0,5	1	1	87%

Resiliency in face of change and adverse conditions	1	1	1	87%

TABLE 6. Moderate-priority elements resulting from Round 3 of the Delphi study

ELEMENTS	IQR	MOD	MED	Important + Very important
Common conceptual misunderstandings of climate change	1	2	2	93%
The contribution of population growth to climate change	0	2	2	93%
Powerful groups block climate mitigation efforts	0,5	2	2	93%
Psychological barriers hinder effective climate engagement	0	2	2	80%
Energy and climate poverty	0,5	2	2	87%
Intersectionality of climate with issues of social, gender and intergenerational justice	0,5	2	2	80%
Planet is warming at different rates in different places	0,5	2	2	80%
Existence of solutions (solutions are known, however, they need to be implemented at sufficient scales)	1	2	2	80%
Technological and logistic solutions	1	2	2	67%
Economic solutions (carbon pricing, carbon tax, non-financial reporting)	1	1	2	80%
Local decentralized measures	1	2	2	93%
Alternative economic concepts (degrowth, donut economy)	0,5	2	2	80%

Sectoral solutions (energy, transport, heating and cooling, agriculture)	1	2	2	87%
Evaluate the efficiency and impact of these solutions	0,5	2	2	87%
Jevons paradox - increase in efficiency can lead to an increase in overall consumption	1	2	2	87%
Strategic and policy frameworks, agreements at various levels (IPCC, Paris Agreement, EU Green Deal)	0	2	2	87%
Overview of political and apolitical platforms that support climate action	0	2	2	87%
Support for political platforms that have climate within their priorities	1	1	2	80%
Historical context and extent of climate change in the past	1	2	2	73%
Peak oil	1	2	2	60%
Global megatrends	1	2	2	80%
Initiating debate on climate change in diverse contexts	0,5	2	2	80%
Voluntary modesty	1	1	1	80%
Applying for wide societal support for addressing climate change	1	2	2	87%
Networks with like-minded individuals	1	2	2	80%
Capacity to share emotions regarding climate change	1	1	2	80%
Deep relationship with nature	1	1	2	87%
Continuous learning	0	2	2	80%
Respecting diversity and questioning stereotypes	1	2	2	93%
Ability to make compromises	1	2	2	87%
Bravery	1	2	2	87%
Consistency in thought and action	1	2	2	73%

TABLE 7. Disregarded elements resulting from Round 3 of the Delphi study.

ELEMENTS	IQR	MODE	MED	Important + Very important
Climate change impacts on culture	1	3	2	53%
Carbon budget	1,5	1	2	73%
Considers employment within the context of climate change	2	1	2	60%

Three items were disregarded, for not meeting the criteria of either high-quality nor moderate priority items (Table 7).

4.8 EXPERT INTERVIEWS

4.9 Semi-structured interviews overview

Four semi-structured expert interviews were conducted to complement the Delphi results. Whereas the Delphi expert panel was composed of regional Czech and Slovak experts, three interviewed experts came from abroad and represented international organizations. The identity of the interviewed experts is kept confidential. Expert 1 is based in the United Kingdom and is one of the coordinators of the global campaign to demand climate justice. Expert 2 is based in Colombia and works as an environmental and climate specialist at an organization that supports female empowerment. Expert 3 is a programme director of a France-based organization that focuses on stakeholder engagement for local climate action, primarily in Africa. The fourth expert hails from Czechia, represents the private sector and an international network, which aims to scale positive social and environmental impact through entrepreneurial activities.

Three interviews were conducted in English. The fourth was conducted in Slovak, while the expert responded in Czech. The interviewees were informed about the research purpose via email and reminded again at the beginning of the interview. All the interviewees agreed to have the interview recorded. All four experts received the same three questions as the expert panel in the first Delphi survey, namely:

1. What should a young person know to effectively and proactively tackle the climate crisis?
2. What should a young person be able to do to effectively and proactively tackle the climate crisis?
3. What kinds of values and attitudes are indispensable to effectively and proactively tackle the climate crisis?

The English interviews were transcribed using the Otter.ai software, and the mixed Slovak-Czech interview was transcribed manually. Afterwards, the data were thematically analyzed. A deductive approach was chosen, as it "helps focus the coding on those issues that are known to be important in the existing literature, and it is often related to theory testing or theory refinement "(Skjott Linneberg & Korsgaard 2019, 264). The codes applied in this analysis reflected the components of the bicycle model of climate change education. The results of the interviews are presented in the following section.

4.10 Interview analysis based on the bicycle model of climate change education

4.10.1 Wheels – knowledge and thinking skills

Expert 4 was quick to point out that rather than addressing climate change, the learners should understand that we are in a climate crisis.

> *The climate crisis is most likely the gravest crisis humanity has ever faced. The word crisis implies all the things that one should know.*

Still, Expert 4 stressed how it should not be perceived as a crisis in isolation as it intimately ties to the biodiversity crisis. Hence, he agreed with the Delphi expert panel, highlighting the impact on biodiversity and climate tipping points.

Expert 3 highlighted how dynamically the world is changing also within the context of climate change. Education, according to him should provide a scientific base which should help in understanding how the impacts of climate change relate to the professional lives of learners.

> *Because we are in a moment of such an acceleration of so many things, the transition of many sectors, and most of the jobs we are prepared for will not exist anymore, very soon. So, for me, it is important also to see how to prepare those young people for a new world that does not exist yet.*

Echoing the Delphi expert panel, who highly prioritized resiliency in the face of change and adverse conditions, Expert 3 emphasized the importance of being able to work with new frameworks and knowledge flexibly.

> *We will not be able to apply the same frameworks in quite a short time. I think it is important not to frame it too frozen, it has to be something quite flexible. So, you can adopt it to a new context, and a very changing context.*

Expert 1 also recognized the importance of understanding the basics of climate science but cautioned that focusing too much on it could be a mistake. Instead, highlighted the importance of procedural knowledge (Taddicken et al. 2018, 5).

> *There is a tendency to kind of start with the science, but I think that is a mistake, honestly. I think you need some very basic grounding, but I do think you need to have some grounding in how science has made itself.*

Having worked with young climate activists from across Europe, Expert 1 explained that many young people endorse the information-deficit mode and believe that understanding climate science is enough to solve the crisis. He recalls popular climate protest signs and banners with slogans such as Listen to the scientists, or Why should we go to school if you won't listen to the educated. However, as shown on pages 23-26, despite the nearly unanimous scientific consensus on the severity of climate change, our society is still very far from being on the right track to address climate change.

> *They [young people] assume that because it is true, that is enough to, you know, win an argument, or that the truth is enough to move*

> *people to change. I mean, I don't know anything about behavioural science either, but I am pretty sure that it [truth] is not enough to get people to change their behaviours, or their beliefs.*

The single most important thing to understand about the climate crisis, according to Expert 1, is that climate change power.

> *To put it really simply, I think they should understand that it is about power, and it is a function of how power is held and what kind of power is held? By whom? And for what purposes?*

Power, while often overlooked in sustainability literature (Fuchs et al. 2016), allows individuals, groups or institutions "to command the resources, actions, or innermost thoughts of another "(Green 2016, 29). According to John Gaventa (2006, 23), author of the power cube power analysis tool, "everyone possesses and is affected by power", yet its meaning often remains elusive. Power is a multidimensional concept. It takes on many forms and manifests in various spaces, which may or may not allow for public participation.

For example, authorities with their decision-making mandates hold visible power. However, the public and groups most affected by the issue need not be involved in the consultation process. Hidden power refers to what happens behind closed doors. Gaventa (2006, 29) explains that the powerful can "maintain their influence by controlling who gets to the decision-making table and what gets on the agenda." It is no secret that the vested interests of authorities in carbon-intensive industries permeate the climate debate (Lawrence, Peg & Ovens, 2019; Jioti, Lee & Thiel 2020). Learners should pay attention to whose interests and voices are represented when decisions about mitigation policies are (not) made. Invisible power, as Green (2016,30) explains, "causes the relatively powerless to internalize their condition." Invisible power "shapes the psychological and ideological boundaries of participation" (Gaventa 2006, 29).

The Delphi expert panel highly endorsed understanding the establishment of political power, how climate change deepens inequalities, the differing carbon debt of countries or the disproportionately high emissions of the affluent. Likewise, understanding the role of the dominant economic system in

perpetuating climate change is of high priority. The Delphi expert panel ascribed moderate priority to understanding why certain powerful groups block climate mitigation efforts.

Expert 2 chose a different entry point. In her opinion, the crucial things to understand are how humans depend on natural ecosystems and the ecological history of the places.

> *A thing that seems important to me is to explore how different economic systems cross with ecological space. What type of resources to people use nowadays from the ecosystem that make their living habits? Can we identify those links between human and social development, survival, presence, and the interdependence with the ecosystem?*

Just like the Delphi expert panel, who prioritized the connections of global and global dimensions of the climate of climate change, Expert 2 believes that making these connections stand out is one of the challenges of good climate change education.

> *What is challenging to do in a very good ways is to show the link between local, regional, and global realities back and forth. Understanding that local impacts have happened because of global phenomenon. And that the climate change phenomenon can be addressed through global patters, global dynamics, but impact on the local reality, and back and forth.*

Understanding these global patters, according to Expert 2 and in accordance with the Delphi panel well complements understanding global megatrends.

> *It is about being able to read the world, being able to understand big, big trends.*

In line with Schreiner, Henriksen, and Kirkeby Hansen (2005, 9), who suggested exploring climate change as a media issue, Expert 2 warns how media can act as a double-edged sword. While playing an indispensable role in raising awareness, it needs to be approached cautiously.

> *It [media] is useful, but at the same time, well, media is also inserted within the power dynamics of the world, and depends on who you speak to, who talks about you and who takes your voices and who not. It is important to problematize the use of media and the framework the media has done around climate change.*

She illustrated one of the media's shortcomings by overly focusing on individual-level action and focusing on personalities such as young Swedish activist Greta Thunberg.

> *Another huge issue that I see that media is doing is focusing on individuals. Of course, we have Greta as the best example. But I think that is very dangerous because it [addressing climate change] is not a one-person thing. And it is such a dangerous space to be in if we keep repeating that narrative. So yeah, media both as resource, but also as danger.*

Regarding thinking skills, the interviewed experts supported the findings of the Delphi panel. Their calls for understanding the complexity of climate change, including the multiplicity of perspectives to interpret it, can be considered an endorsement of systems and critical thinking.

4.10.2 Frame: identity, values, and worldview

The experts recalled the importance of engaging with values and how our beliefs and worldviews shape our attitudes towards climate change. For example, Experts 3 highlighted the need to continuously reflect on one’s worldviews and what factors are at play in shaping it.

> *Try to put yourself in other place to question, always question your point of view. Because your point of view is the result of a series influences, and those influences are very different depending on each person. It is each social environment, each cultural environment.*

Similarly, Expert 1 noted the importance of understanding how our values and beliefs shaped the world that we live in today.

> *We have this world that we live in, with all of the history that led us here. Understand the beliefs people have, the values they have, and the cultures that we have developed.*

The interviewed experts prioritized self-transcendent values (Schwartz, 2000). Additionally, Expert 1 also addressed the opposing self-enhancement values (Schwartz, 2000).

> *I think it is really pointless to, really futile, to engage with the thinking about climate change at all if you seek to profit from it. One should value people, regardless of who they are, and where they live in the world. The value of empathy. Similarly, related is a sense of what is right and wrong, like fairness, and justice, and equity.*

4.10.3 Chains and pedals: action to curb climate change

Answering what young people should be able to do to engage in climate action effectively proved to be a tricky question. Expert 1 noted how there are infinite answers to this question. Expert 4, in line with the Delphi expert panel, accentuated how young people should be able to communicate and frame the climate crisis not as a threat, but as an opportunity. Thus, action should be constructive, rather than reactive, or defensive. It should contribute to creating healthier and just lives.

Experts 1 and 3 emphasized the crucial role of the care economy, including healthcare and childcare. Nevertheless, more than gaining specific sectoral expertise, young people should consider taking action that contributes to societal

transformation, an element also highly prioritized by the Delphi expert panel. For Expert 1, it entails building an entirely alternative way of living

> *The whole point for me anyway is pointing towards living in community with people in such a way that it pushes back slightly against the way that individuals are and expected, and kind of almost forced to live in, under capitalism, as individual consumers. Very atomized, very disconnected, and therefore uncaring. And disconnected from nature, from land. […] Anything that pushes up against that is worth cultivating.*

An effective climate change education program, according to Expert 4, should not be prescriptive, it should not tell young people what exactly to do. Rather, in line with the initial motivations behind the creation of the education program, each learner should find their own entry-point to facing the climate change.

> *Young people should find their own positions with regards climate change. They should be given a change to harness their talent and inner calling to contribute to the cause. One person could be a communicator, while the other focuses on international collaboration and the third on fair policies for climate migrants.*

Expert 4 also reflected on what kind of action is not appropriate, and his thoughts partially reflected the Delphi expert panel's consensus on the need for group problem solving, effective communication without unnecessary polarization and perseverance.

> *The last thing we need is people going on crusades, who take it too personally and are ready to fight. This is not a helpful approach for facing a problem of this magnitude. To face a systemic problem like climate change, you need to cultivate a calm, thoughtful, and perseverant power.*

4.10.4 Saddle: motivation and participation

Motivating educational experiences, according to Expert 4, emerge from a personal experience. He recalled his own experience of living and working in a slum and how it transformed him.

> *Experience is like a hundred times more effective [in shifting values, beliefs and behaviour] than hearing someone talk about it. Seeing poverty, and seeing desperation changed my identity.*

Expert 4 argued for facilitating transformative learning experiences through which the learners can step out of their comfort zones. The recommendation thus it to design the educational program at the intersection of transformative and experiential learning. Transformative learning, elaborated by Jack Mezirow in the early 1990s, aims at transforming the frames of reference through which the learners interpret their world. It is no easy endeavour as it may evoke unpleasant feelings and discomfort, associated with leaving one's comfort zone. Mezirow (1997,8) explains that transformative learning is not likely to occur is what we learn "fits comfortably in our existing frames of reference."

To facilitate transformative learning, learners should be made "aware and critical of their own and other's assumptions" (Mezirow 1997, 10). The educational program should allow for them to practice "recognizing frames of reference and using their imagination to redefine problems" (Mezirow 1997, 10). Finally, they should be supported in participating in discourse, which Mezirow (1997, 10) explains is "necessary to validate what and how one understands."

Mezirow suggests designing activities that are learner-centred, participatory, imaginative, and interactive. Transformative learning can be inspired and complimented with experiential learning, which contextualizing knowledge and meaning in actual lived experience (Strange & Gibson 2017, 86, 88).

4.10.5 Brakes: operational barriers

Expert 4 stressed the significance of psychological barriers by Elisabeth Kübler-Ross's five stages of grief model. Kübler-Ross developed the model to illustrate

how terminally ill patients come to terms with their passing. These stages, which do not necessarily follow the linear path (Gregory 2021), are denial, anger, bargaining, depression, and ultimately acceptance. Expert 4 believes that most of the Czech public is in denial of the severity of the climate crisis.

> *They don't even want to hear about it, they close their eyes rather than facing it.*

4.10.6 Lamp: hope and other emotions

Apathy, hopelessness, and climate grief are understandable phenomena to Expert 2, who in hindsight recalled her personal experiences. At the same time, she underscored the perils of hopelessness.

> *But I remember many, many moments of feeling like so what? The systems that sustain life are so [swear word] right now that so what, what do we do? We might as well just not care, lose hope, or whatever. And I think again, that is a very dangerous place to be in. I think it is an important realization, but that is not the place where we should stop or where we should fall into. Because, because that is very dangerous.*

By recognizing that hopelessness and grief should not be a stopping point, Expert 2 reinforced the importance of perseverance in line with the Delphi expert panel. Expert 2 offered two ways out of hopelessness. First, she passionately and very bluntly defended the collective efficacy of the climate justice movement.

> *How rude and how immoral it is to make invisible or diminish the power of the many communities through history that have been resisting exploitation and destruction?*

Second, in agreement with the Delphi panel, who advocated for young people to perceive their capacity to change things for the better, Expert 2 also evoked self-efficacy.

> *The fact that we, as a generation, and younger generations have not let the current situation eliminate the power of imagination and eliminate the idea that we can do better. I feel as a superpower, that is a source of power in itself.*

In conclusion and agreement with multiple findings from academic literature (Bandura & Cherry 2020; Busch et al. 2019), cultivating both individual and group efficacies are must-have goals for climate change education.

4.10.7 Handlebar: future orientation

The practice of imagining a better future (Kagawa & Selby 2010; Ojala 2016b) found a strong supporter in Expert 2. Emulating Maria Ojala's (2016b, 52) advice to allow students to design pathways to their desired future, Experts 2 proposes to draw the picture of the future.

> *It is like, where do we want to go? And where are we so that we can pave the way towards where we want to go? And I think that is bold, that is radical, that is political. That is inviting; that is disruptive as well. Just the act of imagining is really powerful.*

5 DISCUSSION AND CONCLUSION

Addressing climate change is not a matter of choice. Young people already perceive climate change as one of the most severe problems facing the world (UNESCO 2021; IPSOS 2021), and many of them are rightfully concerned for their future (Thunberg 2019, 58). Not so long ago, I received a motivation letter from two concerned young people: fifteen and twenty years old, looking for guidance for their climate-related project. They wrote, "We worry about our future and see that many people are already affected by the climate crisis. We feel climate anxiety, but we want to use it as a driving force that helps us fight back harder. We want to do everything we can to mitigate the impacts of climate change and potentially avoid the even worse impacts that threaten us."

In Slovakia, young people lack both the opportunities to systematically learn about climate change and guidance to support their climate action on the ground. The thesis commissioner, the Czech and Slovak sustainability consultancy SUSTO-Sustainability Tools, plans to create a long-term climate change education program to bridge this gap. As climate change education is only beginning to emerge in Slovakia, there is no common understanding of what it should entail.

Societal expectations of education are high. It is considered “key enabler” (UN General Assemby, 2017) of all the UN’s sustainable development goals, a “vehicle for rapid societal change” (Shapiro Ledley, Rooney-Varga & Niepold 2017, 24) and an “essential element of the global response to climate change” (UNESCO, 2015). As climate change is a super-wicked problem, it is perhaps not surprising that learning and teaching about it poses an immense challenge. Expert 1 stressed how climate change “is about everything. It is about history up to now; it is about civilization. Yeah, and it is really really big, and it is bigger than your lifetime, both in its genesis and in where it is going in trajectory.” How can any educational program address a cause bigger than one’s lifetime?

This thesis aimed to discover what elements support learners in effectively and pro-actively engaging with climate change. This exploration will have practical

implications. The findings of the thesis will constitute the building blocks of the Commissioner's non-formal climate change education program. At the same time, they will add to the nascent Slovak climate change education debate in Slovakia. The thesis sought to answer the following two questions:

1. What educational design principles support learners in engaging with climate change effectively and proactively?
2. What learning goals should climate change education pursue?

Mixed-method research was applied, combining a three-round Delphi study with expert interviews. The Delphi study engaged seventeen Czech and Slovak climate change and education experts, seeking agreement on what knowledge, skills, and values should young people cultivate to engage in climate action effectively and proactively. The Delphi process revealed sixty-two highly prioritized items, including concepts, skills, values, and dispositions, that should be reflected within the education program. Additional thirty-three elements were deemed of moderate importance. Four expert interviews with climate professionals brought in a global perspective and provided new insights. The results are summarized in the following parts.

5.1 Design principles to support learner engagement with climate change

To engage with climate change effectively and proactively, learners should explore not only the climate system but also themselves, and others. The literature review, Delphi study, and interviews revealed the importance of focusing on the seemingly invisible forces that influence human behaviour, such as values, beliefs, attitudes, and norms.

Having a grounding in climate science, as well as having a "respect for truth and honouring the facts" (Bernes-Lee, 2019), are amongst the main ingredients of climate action. Nevertheless, learners should understand the affordances and constraints of knowledge, given that truth alone, as Expert 1 explained, "is not enough to get people to change their behaviours or their beliefs." People's beliefs,

which may or may not be scientifically accurate, are often stronger predictors of climate change engagement than knowledge (Vainio & Paloniemi 2013). Climate change beliefs are shaped by a rich diversity of demographic, cognitive, psychological, human-evolutionary factors (Milfont et al. 2015). Unpacking what learners believe about climate change and its solutions should be an important starting point for the educational program.

Humans are unique in the way they think, feel, and behave and thus, learners should reflect on how their personality traits might shape their attitudes towards climate change. In line with that, the educational program should also deliberatively engage with deeply held values. Learners should be guided to reflect on what they consider important and how their values can motivate or limit in taking action. Berners-Lee (2019) suggests focusing on three essential values: equality, respect, and care for the world we live in, and respect for truth. The interviewees and the Delphi panellists highly endorsed empathy, solidarity with others, and a deep relationship with nature. These echo self-transcendent values, which in Schwartz's model of basic values, but also in practice, oppose the rather self-centred and self-enhancing values. Put simply, self-interest contrasts concern for the public good, a concern for equity and fairness may stand against the maximisation of power and wealth.

The climate crisis too can be interpreted as a manifestation of values standing in opposition (Berners-Lee 2019, Cantell et al. 2019, Heberlein 2012). Mitigating the adverse impacts of climate change requires societal transformation (Delphi panel; IPCC 2018), "an entirely alternative way of living" (Expert 1), yet the public may interpret this transformation as a threat to their freedom and autonomy. At the same time, failing to act jeopardizes the wellbeing of people and the stability of life-supporting planetary systems. Values-based climate change education attends to how values materialize in real life and dissects the value conflicts inherent within the climate crisis. It should also address what comforts (if any) are the learners willing to give up and how much of their own time and resources (if any) are they willing to commit to climate action.

The educational design must recognize that good intentions do not automatically translate into tangible and impactful action (Gifford, Kormos & McIntyre 2011;

Csutora 2012; Moser & Kleinhückelkotten, 2018; Stern 2000; Stern & Wolske 2018; Hitchings, Collins & Day, 2015). This so-called behaviour-impact gap can be bridged if the educational program adopts an impact-focused narrative that enables learners to “distinguish cosmetic measures from systemic solutions,” agrees the Delphi expert panel. Furthermore, it should illustrate the rich diversity of ways to participate in climate action so that youth can "find their position" and "harness their talent and inner calling to contribute to the cause (Expert 4).

To stimulate climate action, Busch and colleagues (2019) highlight the need to focus on social norms. Social norms often manifest as an invisible power that shapes what we perceive to be right or wrong conduct. Humans may, often decide to act in a particular way by considering whether others may (dis)approve or based on assumptions about what other people do (Cialdini, 2007). Social norms are associated with a wide range of climate-related behaviours, such as support for energy and water conservation or sustainable food choices (Cialdini & Jacobson 2021).

Social norms play a critical role for young people. They are in a sensitive developmental stage of worldview formation, with peer and other social influence increasingly dictating what constitutes an acceptable opinion or behaviour (Busch et al. 2019; Ojala 2015). Research shows that social influence can be harnessed to motivate the climate engagement of young people. For example, engaging in climate-related discussions with peers is a predictor of climate-friendly behaviour (Valdez, Peterson, & Stevenson 2018). Wallis and Loy (2021, 7), in their exploration of the German Fridays for Future movement, found that "identifying with other people who engage in environmental protection and perceiving that friends become part of this movement" were the highest motivators to join the climate protests. The educational design could thus benefit from inspiring peers who could act as role models for the learners. At the same time, Bush and colleagues (2019, 2404) suggest engaging the learners in collective deliberation, for example, by having them decide which amongst multiple climate solutions contributes to the social good the most.

Whether learners decide to act depends on perceived behavioural control mechanisms. These are perceptions of how easy or difficult it would be to perform

an action, and how likely it is that the action will result in a desired effect. Cultivating learners' self-efficacy, or as Maddux (2012) explains, "the power of believing you can", should be at the forefront of climate change education design. The Delphi panel also highly endorsed the importance of realizing the capacity to change things for the better. Apart from being inspired by role models, efficacy beliefs are strengthened through mastery experiences, such as succeeding with a challenging task or project, words of encouragement, or visioning exercises (Bandura & Cherry 2019; Maddux 2012). Therefore, the education program should have a project-based focus, and ensure that the learners can benefit from mentors, and purposefully engage in futures-thinking.

Futures thinking is critical in evoking hope, but also for putting climate change into a temporal perspective. Learners should understand basic climate scenarios, that is, what kind of future awaits them if business will continue as usual. What perfect futures can they image, and what possible futures they can reach? Imagining a better, alternative future is crucial for understanding what is wrong with our present, and what can be improved.

The education program should strike a balance between individual and collective activities, for solving climate change is a collective task. It is vital to help learners understand they are not facing this wicked challenge alone. Learners should also be guided to experience the power of believing we can, that is, cultivate collective efficacy. Therefore, educational design should allow for collaborative learning and problem-solving, another element that the Delphi panel unanimously considered necessary.

Reflections on values, beliefs, norms, and perceived behaviour controls converge in the theory of transformative learning. It refers to a process whereby "we transform problematic frames of reference" (Mezirow 2009, 92) through which we interpret the world. One of the two major elements of transformative learning, according to Mezirow (2009, 94), is "critical self-reflection on assumptions – a critical assessment of the sources, nature and consequences of our habits of mind." Transformative climate change learning revolves around a critical reflection on assumptions, individually and collectively held value and beliefs, and

how these relate to and influence the self-transcending challenge of climate change.

The second component of transformative learning is the participation in "a dialectical discourse to validate a best reflective judgement" (Mezirow 2009, 94). The purpose of discourse "is to access and understand, intellectually and empathetically, the frame of reference of the other and seek common ground with the widest range of relevant experience and points of view possible" (Mezirow 2009, 91). As emphasized throughout this thesis, grasping climate change calls for an engagement with a diversity of perspectives. Meaningful engagement with this colossal challenge thus requires an ongoing discourse between systemic, local, global, individual, collective, power, value, or identity perspectives. By making sense of them, learners will eventually be able "to read the world" (Expert 2).

To summarize, to inspire effective and proactive engagement, the education program should:

1. Guide the learners in exploring their frames of reference. They should reflect on how their values and personalities stimulate or inhibit climate action. A values-based approach also guides the learners to reflect on the climate crisis as a conflict of values.
2. Create and maintain climate-positive social norms. The education program should enable learning from peers who are already actively and successfully pursuing diverse climate-related projects. Vicarious experiences show role models and others close to them cope with challenging situations. The education program should consider incorporating a mentorship experience within the program.
3. Purposefully cultivate self-efficacy and collective efficacy. A promising way to support individual and collective efficacy is through project-based learning that motivates the learners through mastery experiences.
4. Stimulate futures-thinking and allow for envisioning better futures. Through so-called backcasting exercises, learners should identify what is needed to reach what they consider a preferable future.
5. Allow for both individual and collaborative learning. Students should be encouraged to work in groups to stimulate collaborative problem-solving.

6. Design for an ongoing dialogue between various perspectives on climate change. Simultaneously, it should keep emphasizing and interlinked causes and impacts of climate change.

5.2 Taxonomy of significant learning

The Delphi panel, consisting of seventeen interdisciplinary experts from Czechia and Slovakia, agreed on sixty-two elements, including concepts, thinking skills, values, and dispositions, as high priority constituents of climate change education. Further thirty elements were deemed of moderate priority. This long list of elements reflects both the wickedness of climate change in that there is no simple answer, but also the high level of detail in interpreting expert answers. One Delphi expert felt that "we [expert panel] expect young people to know more than their teacher would. We should distinguish between what is really important and what we think is important for young people to know." How to ensure, as Expert 4 cautioned, that the educational program "is not about everything yet nothing?" And how, as Expert 2 wondered, "to give sufficient amount of detail without losing the big picture?"

In the final part of this thesis, the research findings are organized according to L. Dee Finks' (2013) taxonomy of significant learning. Fink's taxonomy grew out of his concern about the "information dump" (2013, xi) style of teaching. He explains how many teachers "have collected and organized all the information and ideas they have on a given topic and are dumping their knowledge onto (and they hope into) the heads of their listeners" (ibid). Just as we quickly forget about the rubbish we dump in the bin, dumping information on learners quickly loses significance. Significant learning, as its name implies, strives to creating learning experiences that are "truly significant in terms of the students' lives" (Fink 2013, 7).

The taxonomy of significant learning is especially fit for the purposes of this thesis as it defines learning in terms of change. L. Dee Fink (2013, 34) explains "that for learning to occur, there has to be some kind of change in the learner. No change, no learning. And significant learning requires that there be some kind of lasting change." The taxonomy is thus well aligned with the transformative learning approach described in the previous section. Fink's taxonomy is non-hierarchical

and is made up of six, interacting forms of learning. The more they interact, the more significant the learning experience is for the learner.

5.3 Climate change education learning goals

The first form of learning within the significant learning taxonomy is foundational knowledge. It represents specific information, ideas or concepts that form the basis of other kinds of learning (Fink 2013, 34-35). The priority foundational knowledge goals identified through this thesis research are summarized below in table 8.

TABLE 8. Foundational knowledge goals.

1	Learners will understand that life on Earth depends on and is shaped by the climate. They will be able to list the main components of the climate system) and have a basic understanding of their interactions.
2	Learners will understand the carbon cycle, the greenhouse effect, identify the main greenhouse gases and their sources.
3	Learners will explain anthropogenic climate change, the dominant role of carbon emissions, and remember that the total human-induced warming is nearly proportional to cumulative carbon dioxide emissions.
4	Learners will understand how capitalism and anthropocentrism are the root causes of climate change.
5	The learners will understand how climate change impacts biodiversity, food security, health, economy, social cohesion, and political stability.
6	The learner will identify climate tipping points and understand how these may lead to abrupt or irreversible change in our Earth's system.
7	Learners will understand how climate change manifests in different power dynamics and will be able to explain the basic principles of climate justice. They will understand that the impacts of climate change are not borne equally nor fairly and will identify who the most vulnerable groups are.
8	Learners will understand that climate change is not an abstract and distant issue, and how addressing it cannot be postponed. They will explain how climate solutions are not a threat but an opportunity to build healthier and more resilient societies.
9	Learners will understand multiple types of climate solutions and will be able to list various adaptation, mitigation, systemic, and individual solutions.

The second form of learning, application "allows other kinds of learning to become useful" (Fink 2013, 36) and includes thinking skills, or skills that enable one to engage with a particular action. The priority application learning goals identified through this thesis research are summarized in table 9.

TABLE 9. Application learning goals.

1	Learners will critically examine the root causes and proposed solutions to climate change.
2	Learners will analyse how social, ecological, and economic systems interact and influence each other.
3	Learners will analyse various climate scenarios and imagine probable, preferable, and possible futures.
4	Learner will critically assess how media sources report on climate change.
5	Learners will cultivate a growth mindset regarding their capacity to address climate change and contribute to preferrable and possible futures.
6	Learners will assess the impact of their activities on the climate and propose ways to lower that impact.
7	Learners will demonstrate climate-positive behaviours through conscious consumption, waste prevention, resource savings.
8	Learners will assess how youth can exert pressure and lobby for climate protection on various levels and propose ways to apply that pressure.
9	Learners will design solutions to selected climate-related problems and strategically plan their implementation.

Integration, the third form of learning refers to how learners put their knowledge in perspective and connection with other ideas (Fink 2013, 36). Integration learning goals, which emerged as priorities, are presented within table 10.

TABLE 10. Integration learning goals.

1	Learners will relate the global and local dimensions of climate change impacts and solutions. They will identify how climate change will affect their communities.

2	Learners will compare individual and collective solutions to climate change.
3	Learners will compare cosmetic versus systemic solutions as well as low-impact and high-impact climate action.
4	Learners will relate diverse perspectives of climate change to each other. They will integrate diverse interpretation of climate change as a geophysical process, as a power, justice, media, issue, or as a conflict of values.

The fourth type of learning entails what learners learning about themselves and about others. This, so-called human dimension of learning, presents the "human significance of what they are learning" (Fink 2013, 36). The thesis research revealed eight priority learning goals within the human dimension (table 11).

TABLE 11. Human dimension learning goals.

1	Learners will consider how their values, beliefs, personalities, and personal norms frame their relationship with climate change.
2	Learners will recognize the importance of caring for their mental health, and of establishing peer support groups.
3	Learners will come to see themselves as agents of change, they will realize their capacity to change things for the better.
4	They will come to see themselves as active citizens, who can use democratic tools to demand more effective climate action. This includes demanding effective action from elected representatives.
5	Learners will better understand others by understanding how their values, beliefs, personalities, and personal norms frame their relationship with climate change.
6	Learners will communicate about climate change with diverse target and without polarization. Learners will strive to initiate discussions about climate change even though they are uncomfortable.
7	Learners will be able to work in teams to solve problems collectively.
8	Learners will interact and network with other like-minded individuals or groups.

Significant learning should stimulate the development of new interests, or values that are important for the learners. Thus, the fifth dimension of the significant learning taxonomy refers to caring (Fink 2013, 36). Table 12 summarizes the learning goals of the caring dimension.

TABLE 12. Learning goals of caring.

1	Learners will be ready to accept responsibility for the state of the world.
2	Learners will be ready to commit time, energy, and other resources to climate action.
3	Learners will get excited to harnessing talents, passions, and interests in contributing to climate action.
4	Learners will value nature in all its diversity, solidarity, equity, fairness, and truth.

Finally, the sixth category, learning how to learn, entails goals that support the development of autonomous learners (Dee Fink 2013, 36-37). These goals are summarized in the final table 13.

TABLE 13. Learning how to learn goals.

1	Learners will identify reliable data sources and will synthesize multiple sources and forms of information.
2	Learners will formulate useful questions about the affordances and limitations of climate solutions and about the power dynamics within the climate debate.
3	Learners will become self-directed learners who are not overwhelmed by the complexity of climate change.

Identifying design principles and learning goals are only the first steps on the road to the envisioned education program. These findings will be complemented by creating adequate feedback mechanisms, design of learning activities, syllabus, and evaluation procedures. Thanks to the thesis research, these follow-up processes will build on expert consensus and a solid evidence base. Most

importantly, the learners and their experiences within the learning program will determine the quality of the design principles and learning objectives. Hopefully, the research findings will contribute to a lasting change in their lives, who will be able to “read the world” and perceive their individual and collective power to change things for the better.

5.4 Limitations of the thesis research

Several limitations emerged from the selected research methods. Due to time constraints, the experts did not have a chance to express their views on the final list of learning objectives. Nonetheless, the findings will be communicated with them and final feedback will be sought out of the framework of this thesis research.

The Delphi method allowed the experts to share their thoughts at their own pace and anonymously, controlling for potential issues arising from a face-to-face meeting, such as dominant speakers taking over the discussion, or feeling a pressure to reply on the spot. Nevertheless, a face-to-face meeting could have potentially worked better to resolve issues over contentious Delphi items. One Delphi panellists highlighted how meeting fellow peers personally could have worked better by reaching a common interpretation of items.

Some scholars argue that reaching consensus on Delphi particular items is not an appropriate stopping criterion for the Delphi study (von der Gracht 2012). Rather, researchers should prove that expert ratings are not changing too much between rounds. As per von der Gracht’s suggestions (2012, 1533), the stability of the expert responses between rounds two and three was tested using the Wilcoxon matched pairs signed rank test.

The Wilcoxon signed-rank test, which determines the existence of any statistically significant differences between the expert responses between rounds, has been employed in multiple Delphi studies (Brunt et al. 2018; Mubarak et al. 2019; Sterling 2017). Put simply, the test determines whether the responses of experts between the rounds changed significantly or not. The test revealed that on a few items, expert ratings significantly differed. In an ideal situation, Delphi rounds

would have continued until the study reaches stability of expert opinions. Nevertheless, due to foreseeable time constraints and expert survey fatigue, it had been decided to terminate the Delphi study after the third round.

As highlighted by this thesis research, effective climate change education benefits from an active engagement with a variety of perspective. While the research sought to involve a diversity of viewpoints, some voices where not represented sufficiently. For example, the research could have benefitted from a stronger representation of youth.

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