A Conceptual Model for Developing Climate Education in Sustainability Management Education System

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Abstract: Climate change issues are multi-faceted and transcend different parts of society and the economy; they expose future generations to life-long health risks. We have a responsibility to future generations. One way to shape the future is the appropriate design of education systems. In this article we argue that climate education requires a holistic approach which goes beyond classroom pedagogies. We argue that climate education should not be limited to interventions within the field of school curricula alone. We review the main elements of the system of education qualitatively, both at macro- and micro-levels, and attempt to form a point of view. Our main argument is that climate education efforts should be coordinated and institutionalised. Based on our qualitative research in Poland, we developed a conceptual model and linked it to an assessment tool. Our model includes the elements necessary for a climate-oriented education program. We propose certain indicators which can be applied at school and higher levels of education system management. Our suggestions should not be limited to children’s education but should be incorporated into continuing education for professionals such as lawyers and accountants as well as other adult education programs. The science and research results are now rich and reliable enough that they can be applied to systemic social change (not only at the individual level). For this reason our model presents a conceptual framework for implementing systemic change in education systems that supports the efforts of local and national authorities to address climate change. The model is general and independent of national cultures. Our research offers both policymakers and scientists the opportunity to modify our concept and adapt it to local contexts and the national legal system. Our model should provoke decision-makers to introduce necessary changes in the legal system. The development of climate awareness should take a formalised role within a national education system. In this paper we demonstrate a logical process of reasoning ensuing from the literature review through empirical research down to the implementation stage.

Keywords: climate education; school management; climate change; policy planning; air pollution

1. Introduction

Climate issues have been gaining in importance in recent years. Climate changes are observable and not seriously questionable, notwithstanding the studied ignorance of a substantial minority of Americans. In fact, the agreement among scientists regarding the human impact on climate change is greater than that on tobacco as the cause of lung cancer [1]. Governments, organizations, businesses and individuals are becoming alarmed by climate changes but also seeking actionable solutions, goals and strategies aimed at alleviating the situation.

Climate education is an integral part of such solutions. Education develops a country’s economy and society and provides knowledge and skills to the population, as well as...
shaping the development of the nation’s youth. The role of education is crucial in producing a new generation that enables solving the real problems in our world [2], as well as updating older generations as to new directions in educational thought. We face the challenge of redefining a foundational education to keep up with the evolution of skills required to solve problems, innovate and succeed [3].

We argue that using school curricula as the dominant means of implementing climate education (as proposed in several United Nations Educational, Scientific and Cultural Organisation [UNESCO] documents) is important but not sufficient. One step in this direction is through the introduction of more practical management tools.

The aim of our research is to develop a conceptual framework for implementing systemic changes in education systems which support climate change efforts of local and national governments. The aim is to present an integrated conceptual model for climate-focused school management. To do so, we conducted desktop research as well as our own empirical studies in education. We were able to operationalize the concept of climate education so that decision-makers (especially those not directly involved in teaching) have the capacity to re-organize and upgrade management of education towards climate education objectives.

We have divided our study into five sections. The first section presents a literature review outline. We describe the research methodology and results. The following section presents the blueprint for our conceptual model for climate-focused school management. Our model is divided into inputs and outputs and looks both at the school level and the individual benefits to school graduates. We present, based on the blueprint, an evaluation tool for the impact of climate education proposing certain indicators for measuring selected aspects of climate education. Our conceptual model’s ultimate goal is to instil climate education in education systems comprehensively and effectively. We devote the Conclusions section to a discussion.

Our suggestions should not be limited to only children’s education but should be incorporated into continuing education. We offer our findings as a proposition to decision-makers involved in education reforms.

2. Review of the Scientific Literature for Climate Education and Sustainability

UNESCO has been signalling the need for redirecting teaching and learning towards climate education since the early 1990s [4,5]. However, there is little consensus regarding [4] what should and should not happen in climate change education, day-by-day or over the longer term, with regard to:

- Who is responsible for ensuring quality climate change education takes place;
- How to bring about change in educators’ practices to ensure climate change education is educational, fit for purpose, and effective;
- The intended and unintended outcomes of the current provision and reach of climate change education on those involved, as well as those beyond it; and
- What and how to assess, evaluate and research climate change education.

Growing environmental concern appears in the ever-expanding body of knowledge about individual decision-making and behaviour. For example, a study by Lund University’s Nichola K.A. Wynes identified a set of individual actions on climate change according to their impact [6]. Going car-free was the most effective action an individual could take. Another top-of-the-list action was not having children (but this argument is politically debatable, goes against the demographic interests of Global North countries and often is used by right-wing opponents of any climate change arguments).

After fossil fuels, other economic sectors, such as the food industry (especially meat and dairy) and textiles are among the most important contributors to climate change [7–10]. The mere 50% reduction of consumption of animal protein could reduce one’s carbon footprint by more than 40%. The clothing sector represents around 3% of global CO₂ emissions because of energy use to produce attire [11–14]. Educators can imbibe most actions from the education system’s ‘how-to-save-the-planet’ list through a comprehensive
approach within which we describe our conceptual model for climate-focused school management. In conventional thinking, it is the curriculum which is the principal instrument of intervention in the education system.

In our understanding, climate change education is a broader term than ‘environmental education’, extending to such spheres as ‘education for sustainable development’ and ‘eco-social competence’. The result of climate education should be growing ‘environmental literacy’, which in turn should result in such outcomes as:

- Changes in society’s attitudes and values;
- Green innovations powering sustainable development; and
- A growing number of green jobs.

Climate education dovetails in many areas with civic education; thus, it supports democracy and civic society development. As a result, individuals develop a deeper understanding of environmental issues and have the skills to make informed, responsible decisions [15–21]. The learning outcomes of climate education include:

- Awareness and sensitivity to the environment and environmental challenges;
- Knowledge and understanding of the environment and climate challenges;
- Attitudes of concern for climate issues and motivation to improve or maintain environmental quality;
- Skills to identify and help resolve environmental challenges;
- Habits which limit or eliminate such non-environment friendly behaviours; and
- Participation in activities leading to the resolution of environmental challenges.

Climate education aims to form and develop qualities that equip people with the ability to protect and improve the environment. Schools can realise this educational mission by fulfilling specific tasks aimed at the basic components of student development: level of knowledge, skills development and attitude formation.

We argue that climate education should not be limited to interventions within the field of school curricula. The theory of credibility-enhancing displays postulates children learn from models’ actions rather than their words [22,23]. People who themselves engage in non-normative public goods behaviours will be more effective advocates than those who merely extol the behaviours’ virtues [23]. Preparing youth for the challenges related to climate change should not be limited to curriculum modifications. The curriculum’s role in shaping the skills and knowledge of students may be overestimated: ‘Curriculum on its own, even a good one, is not a game changer’ [24]. Schools need to employ a wide array of approaches extending beyond a narrowly defined pedagogy. Such approaches would include the application of knowledge on social influence [25–27] in the form of designing school systems, management processes, communication methods, human resources management strategies, relationship management and more [28–32].

Modern climate education to some extent is a combination of quality content-knowledge and persuasion methods application e.g., [33]. A new report shows green improvements in school buildings have positive impacts on student performance [34]. Green technologies introduced into school buildings have the potential not only to increase the educational impact regarding sustainability but also are able to impact the general quality of education, which only supports the argument that climate education provides many synergies to the current system of education and by no means should be treated as an additional burden. Educators and education systems face the challenge of arguing the urgency and the importance of climate issues before the actual learning process can start. Thus, actions which include social learning and modelling (e.g., teachers advocating for bicycle racks or showers in their school premises, students coordinating recycling programs in their school or energy audits in school buildings) are crucial. Social learning takes place through constant peer evaluation; we adjust our beliefs and actions accordingly. When people see their neighbours taking environmental action such as conserving energy, they infer that people like them also value sustainability and feel more compelled to act [35].

Some examples of social learning may include:
• Patrons at a US cafe who were told that 30% of Americans had started eating less meat were twice as likely to order a meatless lunch [36].
• Half the respondents who knew a person who abstained from air transportation due to climate consciousness declared that they flew less as a result [37].
• In California, households were more likely to install solar panels in neighbourhoods that already had them [38]. This finding is also supported by Rogers [39], who identified five main factors influencing adoption of an innovation.
• Community organisers trying to get people to install solar panels were 62% more successful in their efforts if they had panels installed in their own households as well [38].

The scholarly literature describes the recent developments in school reforms regarding sustainability issues. For example Solís-Espallargas and Morón-Monge describe how to improve sustainability competences of teacher training on the basis of inquiring [40]. Morón-Monge et al. present an approach to prospective primary school teachers’ concepts of environment and biodiversity through their design of educational itineraries [41]. Other authors mostly focus on selected problems and research findings in sustainability in education at the pre-school level [31,42–49] and K-12 level [50–53] in various countries. There is substantially less research in sustainability education for postgraduate students [20] and adults as well as life-long learning [21,54–68]. We have not been able to identify similar approaches to ours, as presented in Section 4 of this paper, regarding a comprehensive approach to education.

As stated earlier, we believe that efficient education systems should encompass a variety of methods of intervention in the learning processes occurring in schools which go beyond the curriculum. To systematise our postulates, we look upon the school as a dynamic system needing a supply of material and intangible resources (inputs) and in a position to produce desirable outcomes (outputs).

3. Research Methodology and Results

3.1. Methodology, Participants and Description

In our research, we analysed the current situation regarding climate education by conducting desktop research, three workshops and in-depth interviews. Fazlagić conducted three one-day workshops in December 2019 with teachers from Polish schools located in Warsaw, Krakow and Rybnik. The selection of these three cities was intentional. According to the Swiss air monitoring platform IQAir, Poland has 36 of Europe’s 50 most polluted cities on an updated list published by World Health Organization [69]. Kraków has been notorious for its bad air in recent years and in the capital, Warsaw, particulate levels tend to be 2–3 times above Poland’s official recommended maximum thresholds. Some 72% of Polish cities violate the European Union’s (EU) air quality target (second only to Bulgaria at 83%). The level of environmental awareness among teachers from those cities was very high, which positively impacted the quality of the findings. Some 70 teachers from the Wielkopolska region answered the questionnaires. Both during the three workshops (frequented by 12–15 teachers each) and in the interviews, we asked the respondents questions on climate education (Table 1) related to our research questions. When analysing the results from the two studies, we used the approaches highlighted in the Handbook of Qualitative Data Analysis [70].
Table 1. Description of qualitative studies.

| Types of Studies                   | Focus Group in 3 Cities                                                                 |
|-----------------------------------|-----------------------------------------------------------------------------------------|
| **A Questionnaire with Open-End Questions** | • 12 teachers from Rybnik  
• 12 teachers from Krakow  
• 15 teachers from Warsaw |
| **Sample size**                   | • 70 teachers                                                                          |
| **Participant Backgrounds**       | Primary and secondary school teachers from Wielkopolska region (including 30 from the city of Poznań)  
Primary and secondary school teachers and Non-governmental Organisations (NGO) activists from Warsaw, Kraków and Rybnik |
| **Recruitment**                   | We sent a request to participate in the research via teacher associations and personal contacts to teachers with experience in climate education or/and having interest in it. We received responses by e-mail  
We held focus group meetings in each city |
| **Research approach**             | We read through each questionnaire carefully and analysed the content. We applied a narrative analysis which involves making sense of individual stories. We highlighted important aspects of their stories that included practical recommendations for the changes in the education system  
One person moderated each focus group meeting. The meeting lasted for four hours including two breaks. We recorded the meetings and analysed the transcripts. We applied a narrative analysis which involved making sense of individual stories. We highlighted important aspects of their stories that included practical recommendations for the changes in the education system |
| **Questions asked to participants of the study** | • From your personal perspective, how would you describe the advancement of climate education in Poland? Are you satisfied with its current state? Why (not)?  
• Should climate education be implemented as a new subject in schools, or rather within the framework of existing subjects only? Justify your answer.  
• Should climate education in schools take under consideration the opinions of the local community (e.g., parents, NGOs)  
• How would you describe the graduate of a climate-focused education? How should education shape that personality formation process in schools to develop awareness of climate issues (climate-focused personality)?  
• How would you organize climate education at school and national levels? What objectives and goals should be pursued? |
3.2. Research Questions and Hypothesis

Based on the above review of the literature we came to the following conclusions:

(A) Climate education is gaining in importance both from the scholarly and policy-making perspectives;

(B) Knowledge is lacking on how to operationalize the postulates of climate education. Specifically, policy-makers do not have appropriate management tools to implement climate education.

Both the aforementioned conclusions led us to formulate the following research questions:

(1) Research question (RQ1): What are the barriers to implementing climate education in Polish schools?

(2) Research question (RQ2): How can climate education be implemented across different school subjects (cross-curricular climate education)?

(3) Research question (RQ3): How should education shape that personality formation process in schools to develop awareness of climate issues (climate-focused personality)?

(4) Research question (RQ4): What would be the distinguishing features of graduates of schools which put into action our postulates?

(5) Research question (RQ5): What would be the goals which teachers should pursue to equip graduates with a universal skill set?

Our hypothesis was that a conceptual model embracing all major aspects of climate education can be developed to provide an analytical framework for school management. Such a model should combine experience from the research findings with a practical approach expected by policy-makers.

We believe that the development of climate awareness should take a formalized role in the national education system and all efforts should be coordinated and put into the legal framework [71]. Based on our literature review and our empirical studies in the following sections of this paper we attempt to develop a conceptual model (Section 4) accompanied by an evaluation tool (Section 5). When developing our model, we assumed that it should contain all key elements necessary for the successful implementation of climate focused education system.

We aimed to develop a culturally neutral construct because in the times of globalization, standardization, cultural diversity and migration, the education can no longer be understood as national education only [72].

We also believe that our conceptual model should instigate discussion among the policy-makers and motivate them to take action. We are aware that the successful implementation of the model will require meeting certain criteria, including the neutralization of the existing barriers in the legal system [71], considering transcultural education [72], as well as the application of information and communication technologies (ICTs) [73]. These factors are undoubtedly important but they fall outside the scope of the main goals of our research. Nevertheless, they definitely require further investigation and attention.

3.3. Results of the Conducted Research

The main findings from our workshops and interviews are two:

(1) We collected answers to the four main research questions (RQ1–RQ4) regarding climate education (see: Table 2).

(2) We were able to formulate descriptive characteristics of a graduate, which was the subject of RQ5.
Table 2. Main findings from workshops and interviews.

| Research Questions                                                                 | Main Findings                                                                                                                                                                                                 |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (1) What are the barriers to implementing climate education in Polish schools?     | • A lack of support from parents (due to political views which do not support climate-related policies or simple lack of commitment);                                                                        |
|                                                                                    | • Religious radicalism, which claims the superior role of human race on Earth, and specifically a lack of approval for birth control as one of the methods for reducing burden on the climate;             |
|                                                                                    | • A lack of teaching materials from climate education;                                                                                                                                                        |
|                                                                                    | • A focus on remedying the problems, e.g., cleaning the world and recycling, rather than eliminating root causes;                                                                                               |
|                                                                                    | • Poor skills of teachers in the field of climate education; and                                                                                                                                               |
|                                                                                    | • Consumer and ‘throwaway culture’—especially the difficulty in post-socialist societies promoting ideas of limiting the consumption for the sake of climate.                                                |
| (2) How can climate education be implemented across different school subjects?      | • A multidisciplinary approach is needed (see: Figure 1). It is based on the assumption that introducing separate school subjects such as ‘climate education’ may be counterproductive. It may decrease the motivation of students to acquire knowledge about climate, because students will treat the issue of climate education as an obligatory task rather than a vision of a better future. |
|                                                                                    | • We obtained over 100 different raw ideas on how to implement a multidisciplinary approach. Below are some examples of climate-related topics grouped according to selected school subjects:                           |
| History                                                                          | – Analysis of the impacts (advantages and disadvantages) of the Industrial Revolution;                                                                                                                      |
|                                                                                    | – The impact of wars on the environment;                                                                                                                                                                      |
|                                                                                    | – Herbalism–Methods of natural food preservation;                                                                                                                                                             |
|                                                                                    | – Everyday items throughout centuries—how they were made, which materials were used?                                                                                                                         |
|                                                                                    | – History of electricity development and its effects;                                                                                                                                                         |
|                                                                                    | – History of urbanization → urban development (‘history of chimneys’);                                                                                                                                       |
|                                                                                    | – Animals and plants protected over centuries;                                                                                                                                                    |
|                                                                                    | – History of national parks;                                                                                                                                                                               |
|                                                                                    | – Food and hygiene over the centuries;                                                                                                                                                                      |
|                                                                                    | – Trade and transportation in the Middle Ages vs. today;                                                                                                                                                     |
|                                                                                    | – History of fashion—what were the clothes made of?                                                                                                                                                         |
|                                                                                    | – What can we find in medieval latrines—waste disposal—how was waste disposed of over the centuries? and                                                                                                         |
|                                                                                    | – What did our predecessors eat?                                                                                                                                                                             |
| Research Questions | Main Findings |
|--------------------|--------------|
| **Physics:**       |              |
| When discussing the types of greenhouse gases; |              |
| - Calculation of the carbon footprint of three selected activities/things that the student uses, e.g., food, transport, equipment/toys; |              |
| - Calculation of the energy system—comparison of traditional heating with renewable energy sources; |              |
| - Calculation of the Earth’s mass after burning all coal; |              |
| - Operating principles of nuclear plants; |              |
| - Examination of insulation properties of various building materials; |              |
| - Comparison of heat consumption by passive and traditional houses; and |              |
| - How does home insulation reduce energy consumption for heating (and heating bills)? |              |
| **Foreign language (English)** |              |
| - Names of organisations, ecological foundations → in English; |              |
| - Translation of labels of consumer products; |              |
| - Writing a petition to local governments for introducing a slow traffic zone; |              |
| - Instructions on how to segregate waste (be attached to bins);Environmental debates on a specific topic + presentation; |              |
| - Professional foreign language related to environmental protection; |              |
| - Names of green jobs; |              |
| - Writing a CV in response to a job post; |              |
| - Describing natural and anthropogenic environments in a foreign language; |              |
| - Pro-ecological activities in Germany, Great Britain and the USA; |              |
| - Labelling of organic products in different countries; |              |
| - Ecological organisations abroad; |              |
| - Ecological problems in different countries and their solutions; |              |
| - Ecological terms in a foreign language; |              |
| - International cooperation with partner countries regarding ecology; |              |
| - Greta Thunberg’s speech; |              |
| - Ecological vocabulary: ‘city of smog’—key words describing a city with high air pollution levels; and |              |
| - The water cycle in nature in English. |              |
| Research Questions                                                                 | Main Findings                                                                                                                                 |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
| (3) How should we shape the personality formation process in schools to develop awareness of climate issues (climate-focussed personality)? | The answer to this question is presented beneath the table where we present a list of learning goals.                                                                       |
|                                                                                   | Below are selected items which were most frequently mentioned by respondents (the full list includes 54 characteristics):              |
|                                                                                   | – Knowledgeable about ecology;                                                                                                                                                                 |
|                                                                                   | – Brave and outspoken—reacting to evil;                                                                                                                                                        |
|                                                                                   | – Resistant to marketing and advertising fashion;                                                                                                                                              |
|                                                                                   | – Tolerant and consistent in his/her actions;                                                                                                                                                 |
|                                                                                   | – Willing to protect him/herself and the family from the negative effects of pollution;                                                                                                         |
|                                                                                   | – Disciplined;                                                                                                                                                                                 |
|                                                                                   | – Conscious of resource conservation (being a person who doesn’t adhere to the ‘buy-use-throw’ theory);                                                                                           |
|                                                                                   | – Aware that ‘what I do’ can affect the ecological situation of my children/grandchildren;                                                                                            |
|                                                                                   | – Well-read in this subject (watching movies about ecology);                                                                                                                                    |
|                                                                                   | – Perceptive—being able to discern causes and effects;                                                                                                                                         |
|                                                                                   | – Empathetic—being sensitive to beauty and order;                                                                                                                                              |
|                                                                                   | – Flexible—willing to change his/her views upon new evidence;                                                                                                                               |
|                                                                                   | – Astute in everyday life habits—filling the refrigerator on a regular basis, he/she doesn’t waste food), he/she uses reusable food packaging; using the eco mode, e.g., in the dishwasher; using natural cleaning agents, e.g., grey soap, vinegar; reducing heating, turning off the heater; insulating buildings, turning off equipment that is not working at the moment, turning off the light, the heating, and the tap after washing hands; drawing attention when wasting resources. He/she does not waste paper and uses reusable packaging; |
|                                                                                   | – Using public transport;                                                                                                                                                                      |
|                                                                                   | – Encouraging others with his/her attitude, inclining others to change habits;                                                                                                                   |
|                                                                                   | – Socially active—taking part in actions related to environmental protection, making others aware of this issue;                                                                             |
|                                                                                   | – Knowledgeable about the economic aspects of manufacturing and service delivery processes—being aware of the cost of producing things, proposing non-consumerist attitudes; |
|                                                                                   | – Bringing home the eco-friendly behaviour (learned at school), e.g., segregating rubbish, recycling, saving water, electricity, paper, manuals, and equipment; |
| (4) What would be the distinguishing features of graduates of schools which put into action our postulates? |                                                                                                                                                                                        |
Planning systemic change in education involves formulating strategic goals. One such goal should be based on a graduate profile (other descriptions for the term include: ‘Portrait of a Graduate’, ‘Vision for a Graduate’, ‘Learning Goals’, and ‘Profile of a Learner’). In our study, we consider a graduate profile as a method to focus climate change efforts in education on a core set of learning goals that support the development of skills and habits of mind that matter in school and beyond. A graduate profile helps clarify what we want pupils and students to master and how they can be active, positive change-agents in the face of environmental concerns.

Our research findings are exploratory. They allow framing the thinking about systemic changes in education.

The idea of a multidisciplinary approach is presented in Figure 1.

Figure 1. The multidisciplinary approach, Source: [18].

Students are not taught civics, art, or music solely to improve their labour productivity but rather to enrich their lives and make them better citizens. Based on the literature review [18,44–49,74–83] and the results from the interviews which we conducted, we were able to answer RQ5 by identifying a list of learning goals which teachers should pursue to equip the graduates with a universal skill set. They include:

- Developing patience/perseverance. Patience requires abandoning the culture of immediacy. Perseverance is the quality that allows someone to continue trying even in the face of difficulty, adversity, or impossibility. Patience is associated with self-regulation, appraisal, meta-cognition and coping.
- Teaching planning skills is the ability to think about and successfully manage activities, with the help of any available resources, to achieve specific goals. Planning is basically a roadmap that guides as to how to complete a task before beginning it. A pupil who knows how to plan personal finance and utilisation of everyday items will also understand the concepts related to environmental protection.
• Developing the knowledge on frugality and environmentalism. The idea of ‘reduce, reuse, recycle’ is as much at home with an environmentalist as with a frugal person. Many innovations were based on the idea of lowering the consumption of, e.g., time, money, energy, human suffering. In Catholic doctrine wasting food is a sin. According to the Pope [69]: ‘mechanisms of superficiality, negligence and selfishness underlie the culture of waste’. He warned that ‘unless we seek to contain food waste, it will be difficult to honour the commitments of the Paris Agreement on climate change and realise the Sustainable Development Goals of the United Nations 2030 Agenda’ [54].

Resourcefulness is associated with the ability to find and use available resources to achieve goals and applying problem-solving knowledge to new situations. Children should understand the origins of different materials and food products and practice ways of maximum utilisation and reuse of those objects.

• Strengthening a sense of belonging to small communities. This involves avoiding the cardinal error made in environmental education of introducing the global perspective at the beginning of the process. Teaching about global warming and global climate change is didactically ineffective. Instead, each pupil should initiate their environmental education by looking at their own local situation interwoven with people around them. Instead of thinking globally, we should talk about the environment, e.g., drying out trees in the neighbouring park, traffic jams at 7:50 a.m. in front of school, and most importantly, the role of local citizens in the situation.

• Developing critical thinking skills is the ability to identify arguments as well as counterarguments and to find ways of weighing the evidence through understanding the logical connection between ideas. In climate education, critical thinking allows recognising patterns which lead to climate change.

• Developing goal-orientation involves pupils seeing a purpose in their actions and efforts.

• Teaching tolerance and social responsibility involves pupils associating unconventional behaviours with positive attitudes, e.g., vegetarianism, riding a bicycle in winter, cleaning up the mess of others. ‘Thinking about future generations’ is associated with long-term orientation and ‘civic imagination’ [70] and getting involved in one’s community.

• Sensitivity to the environment is being able to enjoy and appreciate nature. Teaching students how to appreciate the natural environment and love its beauty will lead them to protect the environment naturally. There are two models—cognitive and non-cognitive approaches—in the aesthetics of nature. The former stresses the necessity of scientific knowledge, including ecology, biology, and geography, while the latter focuses more on imagination, intuition, mystery, and folk tales [68].

We emphasize that in the Polish scholarly literature which refers specifically to climate-focus educational goals for teachers, there are no mentions of climate-related learning goals for students. The educational policy in Poland as of today does not make climate education a priority. There are several bottom-up initiatives carried out by the non-governmental organisation (NGO) sector. These compensate to some degree for the current void in pro-climate education actions at the national level. We identified only three sources in the international literature devoted to this subject (Drake, UNESCO), which refer directly to the educational goals. The cognitive learning objectives are [4,55,83]:

(A) The socio-emotional learning objectives; and
(B) The behavioural learning objectives.

Such a scaffolding may be translated into the following objectives in the field of climate education:

(1) Cognitive learning objectives include the learner’s understanding or knowing:
• The greenhouse effect as a natural phenomenon caused by an insulating layer of greenhouse gases;
• Current climate change as an anthropogenic phenomenon resulting from increased greenhouse gas emissions;
• The human activities—on a global, national, local and individual level—that contribute most to climate change;
• The main ecological, social, cultural and economic consequences of climate change—locally, nationally and globally—and how these consequences can themselves become catalysing, reinforcing factors for climate change; and
• Prevention, mitigation and adaptation strategies at different levels (global to individual) and for different contexts and their connections with disaster response and disaster risk reduction.

(2) Socio-emotional learning objectives include the learner being able to:
• Explain ecosystem dynamics and the environmental, social, economic and ethical impact of climate change;
• Encourage others to protect the climate;
• Collaborate with others and develop commonly agreed-upon strategies to deal with climate change;
• Understand their personal impact on the world’s climate from a local to a global perspective; and
• Recognize that the protection of the global climate is an essential task for everyone and the need to completely re-evaluate our worldview and everyday behaviours in this light.

(3) Behavioural learning objectives include the learner being able to:
• Evaluate whether their private and job activities are climate-friendly and—where not—to revise them;
• Act in favour of people threatened by climate change;
• Anticipate, estimate and assess the impact of personal, local and national decisions or activities on other people and world regions;
• Promote climate-protecting public policies; and
• Support climate-friendly economic activities.

We concluded that climate education should not be limited to schools; it should also be an integral part of continuing education programs for professionals such as lawyers and accountants, as well as other adult education programs [66,67,70].

The education system should take under consideration that climate change is dynamic; it appears in different areas [60,61,83–89]. Knowledge of climate change, therefore, should constantly evolve as new research provides new findings and discoveries. To highlight the phenomenon, we referred to the different stages of education and human development (Figure 2). We claim that each stage should be associated with a corresponding approach to climate education. Climate education should not only concentrate on knowledge development but, first of all, should shape the value system and an ability to take actions to benefit the climate [40–48,61–64,83,89–91].

Our conceptual model postulates that the systemic change in education should reflect these four stages. We describe each stage in Table 3. They include such parameters as age, place and form of education. The three most important stages concern 1/3 of human life combined, which are extremely important in shaping the value system. In the composition of society, it is the younger generation which is most affected by new learning concepts. The current shape of climate education will have an unquestionable impact on the climate change issues in the next decades. The current graduates of the education system will become future consumers and business and political leaders. The development of appropriate attitudes and life priorities is crucial to ensure that they make the right choices in the future. Climate education aims not only to impact the actions of individuals but also to shape the political preferences of soon-to-be voters who may exert pressure on politicians to set their political agendas with climate goals as a priority. Informal, post-degree education also plays a role in influencing the behaviours and attitudes of citizens.
The current shape of climate education will have an unquestionable impact on the climate change issues in the next decades. The current graduates of the education system will take actions to benefit the climate [40–48, 61–64, 83, 89–91].

We address each stage in Table 3. They include such parameters as age, development (Figure 2). We claim that each stage should be associated with a corresponding approach to climate education. Climate education should not only concentrate on knowledge development but, first of all, should shape the value system and an ability to approach the phenomenon, we referred to the different stages of education and human development (Figure 2). We believe that the proof of the model’s practical orientation.

Thus, our proposed evaluation should provide that sense of direction for school leaders and policymakers that sustainability should be the foundation of the curriculum as supported by the statement by Deming [45], who claimed that 94% of quality issues were caused by the system—and not the workers (in our case, the teachers).

A popular form of education for senior citizens is “third age” universities, which are gaining in popularity in Poland and elsewhere. There are many forms of informal education for elders [21, 89] which would include social learning (for example from grandchildren) and media. Since climate concerns are strongly associated with citizen values and general maturity and responsibility, the elder generations maybe more susceptible to uniform climate education than younger generations. By enhancing their knowledge about climate issues, their climate education may be just as effective as the formal education of the youth.

In our conceptual model, we limited the scope of analysis to formal education offered to students aged up to 26, as this part of the system is most susceptible to interventions at government levels.

The strengths of our methodology include the application of three qualitative methods (desktop research, three workshops and in-depth interviews), as well our literature review, which increases the reliability of the findings. We were interested in both the current state-of-the-art in climate education and in receiving hands-on feedback from practitioners. We base our model on the assumption that school curricula are the only sufficient area of intervention in education. Our holistic approach assumes that students in school should be exposed to a variety of stimuli, including teachers as role models, school management practices, facilities management, as well as school and leadership styles. The model itself conveys a message to the decision and policymakers that sustainability should be taught so that schools become centres of climate-focused education. The weaknesses of our methodology include the limited geographical scope of the findings (i.e., from Poland). A strength of the model which is of universal applicability may also be considered as its weakness, since different countries may have special unique features which are not considered within our model. After the development of the conceptual model, we went further and proposed an evaluation tool which proposes a set of indicators for performance measurement in climate education. We believe that the proof of the model’s value will be its ability to make a positive difference in schools. The model needs a strong practical orientation.

In most education systems, schools and theatres are subject to evaluation procedures. Thus, our proposed evaluation should provide that sense of direction for school leaders and school administrations. In this paper we demonstrate a logical process of reasoning ensuing from the literature review through empirical research down to the implementation stage. It is important not to overlook that we conducted our research in cities which record some of the highest levels of air pollution in the world [69].

Based on the assumptions and findings presented in this section, we concluded that a systematic approach for climate education is necessary. We need to create a system rather than focusing our attention on the teacher–student interactions in schools and the content of the curriculum as supported by the statement by Deming [45], who claimed that 94% of quality issues were caused by the system—and not the workers (in our case, the teachers).
Table 3. Climate education in the lifespan of humans.

| Description | Stage | Pre-school Stage 1 | School Education Stage 2 | Higher Education Stage 3 | Adult Education Stage 4 |
|-------------|-------|--------------------|--------------------------|--------------------------|-------------------------|
| Age         |       | 2–6                | 7–18                     | 18–26                    | Above 26                |
| Educational institutions | Kindergarten          | Primary and secondary school | Higher education Institution |                           |
| Forms of education | Play and games | Pre-school trips | Formal school curricula | Academic programs | - Media |
|              | School trips       | Extra curricular activities | - Protects             | - Social learning       |
|              | (eco-competitions, eco-projects between schools) | Eco-competitions (eco-competitions, eco-project, etc.) | - Internships | - Informal knowledge transfer |
|              |                    |                      | - Master thesis         | - Third age universities |
|              |                    |                      | - Eco-projects with scientists and practices | - Postgraduate studies |
|              |                    |                      | - Eco-competitions (competitions for Master’s thesis, eco-project, etc.) | - Courses |
|              |                    |                      |                          | - Media releases       |
We believe that there are many synergies between climate and ‘non-climate’ education, and the implementation of a climate-focused school management approach by no means compromises other learning objectives.

4. A Conceptual Model Blueprint for Climate-Focused School Management

We developed a conceptual model for school management aiming to increase the efficiency of climate education. We divide the tenets into two parts: inputs and outputs.

The inputs represent the actions and resources required before the student enters the school system. Inputs are supposed to create a learning environment within which the overall aims of education align with the climate agenda. We further divide inputs into macro-level and school-level inputs. The inputs at the macro-level concern the education system as a whole, provided and organised at national and regional levels. Our conceptual model outputs are the short- and long-term results for the students, parents, local communities, and larger society out of the transformation. The output side of our model should provide feedback to the governing bodies and allow for modifications of inputs. Our model is independent of national cultures. Our conceptual model’s ultimate goal is to instil climate education comprehensively and effectively.

Figure 3 presents our model’s main tenets.

![Figure 3. Integrated conceptual model for climate-focused school management.](image)

Table 4 presents the blueprint for the conceptual model for climate-focused school management.

The first category of inputs is macro-level inputs. The inputs represent the actions and resources required before the student enters the school system. These inputs include:

- **Legal framework.** Each school operates within a legal context grounded in the national and regional laws and regulations. Legal frameworks in the education system may help green, low-emission and climate-resilient development. These laws in most instances are climate-neutral, but governments may want to provide school administrators with school-specific rules and regulations which promote climate-friendly management processes and pedagogies (see, e.g., [83,85,92]).

- **National curriculum.** Many countries express environmental concerns by including climate-focused components into the curricula of selected subjects, such as chemistry or biology. With our model, we postulate a multidisciplinary approach, where climate focus is present, in different forms, in all subjects taught at school (see for example: [44–54]).

- **Formal teacher education.** Climate education crosses traditional disciplinary fields. For example, a biology teacher may be well-equipped to teach the flow of matter and energy in ecosystems but less familiar with the chemistry involved in acid rain formation. A social studies teacher is unlikely to be conversant in the biogeochemical cycles that are key to understanding global climate change. A need also exists to connect gaps and disconnects between ethics, awareness, intention, beliefs, commitments and action [4]. Concepts such as comparative risks and trade-offs are often integral to addressing environmental concerns, but these ideas are new to many teachers [40,41,93].
• General expenditures on education. Governments must devote additional funds to education to meet the challenge of preparing students for an increasingly complex 21st-century world.

• Textbooks. Textbooks are one area of climate education needing improvement. Most science and social studies textbooks only include a sidebar or chapter on environmental concerns [49]. Studies in recent years have pointed to the inadequacy of textbooks. Textbooks are frequently vocabulary-laden, superficial in coverage of important content, and often full of errors and dated information. Textbooks rarely present themes and principles driving understanding effectively [55].

Table 4. The blueprint for the conceptual model for climate-focused school management.

| Inputs                                | Outputs                                      |
|---------------------------------------|----------------------------------------------|
| **Macro-Level Inputs**                | **Macro-Level Outputs**                      |
| Legal framework                       | Improved situation of the Earth’s climate   |
| National curriculum                   | Reduced burden on the environment           |
| Formal teacher education              | Increased quality of life                    |
| General expenditures on education     | Green innovations                           |
| Textbooks                             | Sustainable economic growth                  |
|                                       | Healthier democracies                       |
|                                       | Reduced health-care costs                    |
| **School Level Inputs**               | **Individual Benefits (Outputs)**           |
| Vision and mission statements         | Achieving learning objectives               |
| School strategy                       | Climate-focused development of graduates     |
| School infrastructure                 | Greater employability                        |
| Recruitment of teachers               | Increased quality of life in a green environment |
| School culture                        | Lower risk of falling ill with lifestyle diseases and allergies |
| Climate-friendly purchasing           | Better quality of products and services (e.g., vegetarian food vs. meat consumption), electric vehicles operated by municipalities |
| In-service teacher training and teacher development | More effective teaching strategies in schools, increasing the learning resulting in greater student achievements |
| Leadership                            | More coherent and focused teaching strategies in schools, increasing the learning, resulting in greater student achievements |
| Employment of educators who are genuinely passionate about teaching and love children |
| Teachers                              | Better school and experience climate         |
|                                       | More effective teaching strategies in schools, increasing the learning, resulting in greater student achievements |
|                                       | Instilled motivation for growth              |

The second category of inputs concerns the school itself. Many but not all inputs are a direct extension of the inputs from the macro-level. The school-level inputs include:

• Vision and mission statements. Schools are usually free to develop their own vision and mission statements. As long as they put an emphasis on the climate issues, they may be considered as inputs for the climate education at school level.

• School strategy. The school head may pursue a strategy including strategic goals related to climate issues. The implementation of the postulates included in this paper could characterise a strategy for a climate-focused school.

• School infrastructure. School infrastructure is associated with the school building, information technology infrastructure and school equipment. It may play a vital role
within the holistic model of a climate-focused school. Elements of school infrastructure such as photovoltaic panels, energy management, interior design and materials could be used as ‘live-examples’ of climate focus.

- **Recruitment of a teaching staff.** The provision of climate education requires the recruitment of a teaching staff sharing a concern for the environment, creative in its teaching methods and ready to work jointly with other teachers. The process of continuous learning should involve teachers and upgrade their teaching skills and knowledge.

- **School culture.** School culture includes the values, beliefs and attitudes that teachers espouse and demonstrate. It also refers to the perceptions, relationships, attitudes, and rules (written and unwritten) that shape and influence every aspect of school functions. Teachers should demonstrate and manifest these cultural elements regularly, including such methods of social interaction as modelling. Naturally, the more aware and climate-friendly the school culture, the better the environment for climate education.

- **Climate-friendly purchasing.** Climate-friendly purchasing is the procurement or acquisition of goods and services for the school which are a lesser or reduced source of greenhouse gas emissions when compared with competing goods or services serving the same purpose. The priority should be given to all market offerings which deliver positive learning outcomes for students interacting with them.

- **In-service teacher training and teacher development.** Teacher education consists of two major components: pre-service and in-service education. Given the inertia of bureaucratic systems in many countries, in-service training should be the focus of the dissemination of knowledge and skills on climate education. Pre-service teacher training at universities should follow.

- **Leadership.** Leadership in climate education means mobilising and guiding the talents and energies of teachers, pupils, and parents toward achieving common educational goals. It is a process of social influence, maximising the efforts of others. The personality, experience and skills of school heads are crucial in achieving synergies among the different components of climate education [42,57,62–65,78–82,89,94–97].

- **Relationships with external stakeholders.** Relationships with external stakeholders involve the way in which the school uses external stakeholders and resources to support climate education. They include parents, local community members, businesses (especially those involved in the green economy), local government, and non-governmental organizations [69,96,98–101].

Our conceptual model outputs are the short- and long-term results for the students, parents, local communities, and larger society out of the transformation process. We divide them into macro-level outputs and individual outputs, or benefits to the graduates of climate education.

The macro-level outputs include:

- **The improved situation of the Earth’s climate.** If the Earth is to meet the goal of limiting global temperature increases to 1.5 °C set in the Paris Agreement in December 2015 [99], it will most likely be the result of a ‘grass-roots’ (i.e., from the bottom up) movement from a populace educated to the dangerous consequences of global warming.

- **A reduced burden on the environment.** Education is the main tool necessary to reverse the unsustainable levels of resource consumption of the late 20th and early 21st centuries.

- **Green innovations.** Climate-oriented education, particularly in the ‘STEM’ (namely science, technology, engineering and mathematics) subjects, will encourage the green innovations that will make achieving the Paris Agreement thresholds possible.

- **Sustainable economic growth.** In a time of aging populations in the Global North and overpopulation in the Global South (particularly South Asia and Sub Saharan Africa), climate education will be necessary to realise sustainable economic growth.
• Healthier democracies. Using climate education to attain the above outputs will help to thwart the current wave of populism and strengthen democratic institutions.

• Lower costs of healthcare—climate education, although indirect, should result in improved lifestyles and reduce the number of civilisation diseases. These lower costs in turn should also support the economy, as healthier citizens are more productive and require fewer public funds.

The individual-level outputs include:

• Achieved learning objectives. Climate-directed education sounds great, but unless it achieves the defined learning objectives, it will mean much wasted effort and resources.

• Climate-focused development of graduates. As slowing global warming becomes increasingly urgent, greater sensitivity and understanding of climate change issues will become more and more necessary, not only for employability but for meeting the challenges of everyday life.

• Greater employability. In a world where the search for jobs is increasingly competitive and jobs require more technical competence, climate-directed education will provide candidates better equipped to meet the requirements of 21st century jobs, many types of which do not exist today.

• Increased quality of life in a green environment. Reducing the extent of global warming and the resulting extreme weather events, as well as the pollution from excess resource consumption, will improve the quality of life for most if not all world residents.

• Lower risk of falling ill with lifestyle diseases and allergies—the personal benefits go in line with societal benefits. Increased productivity should result in higher personal income and general wellbeing.

The personality of a climate-focused graduate represents a set of beliefs, values and attitudes, as well as knowledge, which are conducive to a better climate. They may manifest themselves in all spheres of life, ranging from everyday climate-friendly habits and decisions up to successful businesses or political careers. A graduate profile (other descriptions for the term include: ‘Portrait of a Graduate’, ‘Vision for a Graduate’, ‘Learning Goals’, and ‘Profile of a Learner’) is a description of expected traits of character, attitudes and behaviours linked to climate concerns and issues. Bouman et al. [102] point out four human values which are key determinants of a wide range of environmental beliefs and behaviours. These values underlie individuals’ environmental beliefs and behaviours: (1) biospheric (i.e., concern for the environment; (2) altruistic (i.e., concern for others; (3) egoistic (i.e., concern for personal resources); and (4) hedonic values (i.e., concern for pleasure and comfort) [96]. We considered a graduate profile as a means of focusing climate change efforts in education onto a core set of learning objectives that support the development of skills and habits of mind that matter in school and beyond. A graduate profile helps clarify what we want pupils and students to master and how they can be active, positive change-agents in the face of environmental concerns. We emphasise that there are hardly any contradictions between the postulated traits of a climate-focused school graduate and the provision of quality education. On the contrary, climate education develops many universal skills. Thus, the pursuit of climate education goals is by no means in conflict with the development of general knowledge and skills. Rather, given the complexity of climate issues facing the world today, one can imagine that a climate education background will indeed help graduates in their adult life [4,59,76,94–96,100,103–108]. The in-depth interviews and three workshops (see: Table 1) which we conducted in Poland support this point.

5. A Tool for Assessment of a Climate-Focused School

Based on the conceptual model presented in the previous section, we propose a set of indicators which further conceptualise our blueprint. By proposing this toolset, our aims are:

(a) to make our research findings more operational; and
(b) to strengthen the argument that for climate education to succeed, its implementation process must be a systematic, all-encompassing approach.

Table 5 includes proposed measures for assessing the performance. Where possible, we included quantitative measures. Otherwise, we used a descriptive approach.

Table 5. Evaluation tool for the impact of climate education.

| Assessment Criteria                  | Indicators                                                                                                                                 |
|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|
|                                      | **Macro-Level**                                                                                                                              |
|                                      | **Legal framework**                                                                                                                          |
|                                      | • Number of provisions in the legal documents governing the system of education related to climate education;                             |
|                                      | • Number of mentions and keywords in the legal documents governing education related to most appropriate climate keywords;                 |
|                                      | • Climate neutrality versus climate focus in legal documents—qualitative judgments regarding keeping with the spirit of sustainability reporting guidelines; |
|                                      | • Green procurement regulations;                                                                                                            |
|                                      | **National curriculum**                                                                                                                      |
|                                      | • Number of mentions of key words;                                                                                                          |
|                                      | **Formal teacher education**                                                                                                                 |
|                                      | • Number of mentions of key words;                                                                                                          |
|                                      | **General expenditures on education**                                                                                                        |
|                                      | • Value of climate education projects and initiatives;                                                                                       |
|                                      | **Textbooks**                                                                                                                               |
|                                      | • Number of mentions referring directly and indirectly to climate issues;                                                                     |
|                                      | • Number of models and formulas which include a climate-related component;                                                                    |
|                                      | • Number of words—volume of text devoted to climate issues.                                                                                  |
|                                      | **School Level**                                                                                                                            |
|                                      | **Vision and mission statements**                                                                                                            |
|                                      | • Descriptive indicators—content analysis, may have direct reference to the climate or an indirect one, e.g., pointing to civic responsibilities; |
|                                      | **School strategy**                                                                                                                         |
|                                      | • Direct and indirect references in the text of strategy to climate issues (indirect references may include, e.g., citizen education);          |
|                                      | **School infrastructure**                                                                                                                    |
|                                      | • Green technologies used in school buildings and their surroundings (e.g., solar panels, photovoltaic (PV) panels);                            |
|                                      | **Recruitment of teachers**                                                                                                                  |
|                                      | • Criteria for selecting teachers for teaching positions including climate education postulates;                                               |
|                                      | **School culture**                                                                                                                          |
|                                      | • Espoused values supporting climate education (which may be identified by means of standardized questionnaires for the measurement of organizational culture); |
|                                      | **Climate-friendly purchasing [54]**                                                                                                         |
|                                      | • Purchase of office and cleaning supplies and equipment that minimise environmental impacts and that do not have a negative effect on human health; |
|                                      | • Amount of time assigned to specific climate issues in the curriculum/class scenarios; new equipment that meets Energy Star or comparable energy efficiency standards, and computers that meet the highest feasible Electronic Product Environmental Assessment Tool certification level; |
### Table 5. Cont.

| Assessment Criteria                          | Indicators                                                                 |
|----------------------------------------------|-----------------------------------------------------------------------------|
| **Inputs**                                   |                                                                            |
| **Macro-Level**                              |                                                                            |
| • Computer and lighting controls that reduce energy and computer idle time; |                                                                            |
| • Rechargeable batteries, where appropriate; |                                                                            |
| • Recyclable or reusable cups, plates and utensils; |                                                                            |
| • Green building materials that create a healthier and more sustainable environment; |                                                                            |
| • Implemented practices of not purchasing new materials, such as office supplies and furniture, through the reuse of existing items in surplus when appropriate and feasible; |                                                                            |
| • Providing incentives for car pooling and using climate-friendly forms of transport for teachers, students and parents; |                                                                            |
| **In-service teacher training and teacher development** |                                                                            |
| • Number of teacher training courses devoted to climate education and climate issues; |                                                                            |
| • Number of hours spent in training on the climate related issues per teacher; |                                                                            |
| **Leadership**                               |                                                                            |
| • Values espoused by school leaders (which may be analysed by means of standardized leadership measurement questionnaires); |                                                                            |
| • Content of school and vision strategies;   |                                                                            |
| • Strategic priorities of school leaders (as declared in surveys, etc.); |                                                                            |
| • Strategic priorities of school governing bodies (as declared in strategic documents, e.g., education policies); |                                                                            |
| **Relationships with external stakeholders** |                                                                            |
| • Maintaining contact with representatives of the green economy, e.g., employers, non-governmental organizations. |                                                                            |
| **Outputs**                                  |                                                                            |
| **Macro-Level**                              |                                                                            |
| **Note:** Such outputs require longitudinal studies. Below are the questions which could be considered for such research |                                                                            |
| **Improved situation of the earth’s climate** |                                                                            |
| • It is hard to isolate the impact of school education on the behaviours of individuals who graduated from the education system. Case studies and individual stories of leaders who made an impact on climate may reveal some relationships with the previous educational background; |                                                                            |
| **Reduced burden on the environment**        |                                                                            |
| • Same as improved Earth climate situation;  |                                                                            |
| **Improved quality of life**                 |                                                                            |
| • Same as improved Earth climate situation;  |                                                                            |
| **Green innovations**                        |                                                                            |
| • It is much easier to identify the background of green innovators by analysing ex post educational experiences and possibly finding some contributions from schools and teachers; |                                                                            |
| **Sustainable economic growth**              |                                                                            |
| • Same as improved Earth climate situation;  |                                                                            |
| **Healthier democracies**                    |                                                                            |
| • Citizenship education goes hand-in-hand with climate education. The development of citizen values should naturally support other initiatives and public support for climate change issues. |                                                                            |
Table 5. Cont.

| Assessment Criteria                          | Indicators                                                                 |
|----------------------------------------------|----------------------------------------------------------------------------|
| **Inputs**                                   |                                                                            |
| **Macro-Level**                               |                                                                            |
| Individual Perspective                       |                                                                            |
| Achieving learning objectives                | • If new curricula including climate focus are introduced, all examination procedures can be naturally enriched with evaluation criteria for students regarding climate issues; |
| Climate-focused development of a graduate    | • Same as improved earth climate situation;                                |
| Greater employability                        | • With the growth of the green economy, the number of green jobs will increase. School graduates equipped with knowledge and values focusing on the climate may naturally have an advantage on the job market; |
| Improved quality of life                     | • Most climate-friendly behaviours of consumers and citizens support improved quality of life, e.g., using a bicycle instead of a car. Thus, we can assume that the improved quality of life will be at least partly attributed to increased environmental awareness due to climate education. |

The evaluation tool presented in Table 2 can be modified to adjust the indicators to the specific needs and context. A full scale implementation should consider those factors which characterise the national and regional perspectives. Nevertheless, we argue that some level of standardisation at national and international level is key to achieving meaningful impacts.

We believe that the value of the model will be schools that are subject to evaluation procedures. Thus, our proposed evaluation should provide that sense of direction for school leaders and administrations. In this paper we demonstrate a logical process of reasoning ensuing from the literature review through empirical research down to the implementation stage.

6. Conclusions

One of the pillars of societies is undoubtedly education. In our opinion, there should be no compromise between climate education and overall educational goals. The science and research results are now rich and reliable enough that they can be applied to systemic social change (not only at the individual level). Our research aimed to develop a conceptual framework for implementing systemic change in education systems that supports the efforts of local and national authorities to address climate change.

These results, supported by our literature research, led us to develop learning goals for a climate-driven school. Based on our research, we proposed a conceptual model for climate-oriented school management aimed at increasing the effectiveness of climate education. In our conceptual model, we propose a systemic approach to climate education by offering a conceptual framework allowing schools to manage and execute climate-related learning objectives. The implementation of a climate-focused school management approach by no means compromises other learning objectives.

Our model includes the four elements necessary for a climate-oriented education program. We define the required inputs and outputs, dividing both categories into macro and school/individual level elements. Next, we list the goals that a climate-oriented educational program should set, dividing them into three categories—cognitive, socio-emotional and behavioural. We conclude by examining the personality traits that a student would exhibit when he achieved the goals of this program. As it is one of the first attempts in the literature to formulate a comprehensive model of climate education management, we propose this model as a prototype for developing such programs in practice.

Our model has some weaknesses. It is independent of national cultures and, therefore, general. The generality of our model is both its weakness and its strength. In our article,
we present the results of our qualitative research among teachers, including teachers from one of the most polluted cities in Europe. Our workshops and interviews took place in one country, Poland, which, while representing European countries in many respects, is unique in many respects (e.g., its dependence on coal as the main part of the energy base). The foundations of the model are weak and need to be strengthened through further research in other countries and contexts.

As it is a first attempt to formulate a comprehensive model of climate education management, the model should be treated as a prototype—for a clean solution. Our research offers both policymakers and scientists the opportunity to modify our concept and adapt it to local contexts. For example, when proposing specific indicators for climate-friendly purchasing, researchers should take into account the national legal system. However, having faced possible obstacles on the side of the legal system without obstacles, we identified serious weaknesses. The model should encourage decision-makers to introduce necessary changes in the legal system. The generality of our model is both its weakness and its strength. By confronting our findings with the current state of affairs, we can take them as a point of reference and develop a roadmap to improve the organisation of education systems.

We argue that the concepts presented in this paper should instigate discussion about systemic changes in education. We suggest further research regarding the applicability of the presented concepts and ideas. Climate education should be part of the political agenda within all green economy programmes and strategies at national, regional and municipal levels. All climate-related education initiatives should consider the opinions of youth. We urge further research on how to utilise the intellectual capital of the younger generation to design institutional changes and school curricula.

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