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(Climate) Change in young people's minds – From categories towards interconnections between the anthroposphere and natural sphere

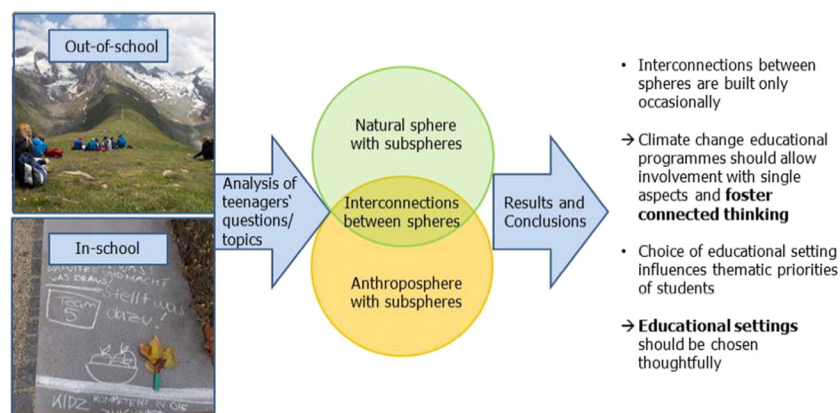
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HIGHLIGHTS

- Topics teenagers connect with climate change are analysed.
- Two different educational settings are compared.
- Students' ability to build interconnections between spheres is investigated.
- Teenagers mainly consider questions in terms of single spheres.
- The educational setting influences students' thematic choices.

GRAPHICAL ABSTRACT



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ABSTRACT

The grand challenges of the 21st century will increasingly require societies to reconsider the pathways taken thus far. Engagement with climate change is of ever-growing importance to young people. They will be confronted with the effects of climate change throughout their entire lives and, as future decision-makers, they will vitally shape societal developments. Education will thus play a crucial role in the transformation to a sustainable society. In terms of awareness-raising, an important first step in preparing young people for the challenges of the 21st century is to understand what content is connected with climate change. As complex challenges, such as climate change, demand ways of thinking that go beyond categories, interconnections between the anthroposphere and the natural sphere have to be taken into consideration. This study provides an insight into the questions and topics young people develop whilst becoming involved in climate change in an in-school learning setting and in an out-of-school learning setting (a high mountain environment). The analysis focuses on the question of in which spheres students predominantly make their thematic choices and how far the interconnections between different spheres are formed. Our results show that the choice of the learning setting influences the topics students connect with climate change. Interconnections between sub-spheres of the anthroposphere and natural sphere are made only occasionally. These findings serve as a basis for reconsidering the content and foundation of climate change communication with young people. We recommend that climate change educational programmes should include phases that allow the following: a) involvement with climate change issues related to single spheres in the first phase, and b) consideration of the interconnections between spheres when

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becoming involved with climate change issues in the second phase. As the educational setting can considerably influence the focus of the learning process, it should be chosen thoughtfully.

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1. Introduction

In the year 1896, the Swedish chemist and physicist Svante Arrhenius was one of the first to describe the issue of the greenhouse effect. At first, this was mainly thought of as an environmental issue, a chemical phenomenon affecting the earth's climate system (Arrhenius, 1896). The focus of the climate change debate was still on scientific findings when it became a growing issue “in the mid-twentieth century, [when] some physical scientists – named as such due to the archaic Western convention of studying the physical world in isolation from social systems – recognised that the anthropogenic increment of CO₂ could theoretically warm the planet” (Oreskes and Conway, 2014, p. 2). Currently, approximately 120 years after Arrhenius's findings on the “influence of carbonic acid in the air upon the temperature of the ground” (Arrhenius, 1896), the strong interaction of the natural sphere¹ and the anthroposphere² in the context of climate change is gaining more awareness (Voss, 2010; Dryzek et al., 2011; Steffen et al., 2015; Pope Francis, 2015; Crutzen, 2002).

Going beyond the physical changes in the earth's climatic system, a view integrating both the natural sphere and the anthroposphere is essential for gaining a more comprehensive understanding of climate change and its consequences (Kates et al., 2000; Mittelstraß, 1987). This integrative perspective is a prerequisite for facing the challenge of moving towards a non-carbon society, which requires that humanity “ensure[s] that it meets the needs of the present without compromising the ability of future generations to meet their own needs” (Hardtke and Prehn, 2001, p. 58). Based upon this, mitigation and adaptation strategies and, consequently, transformation strategies, can be developed (WBGU, 2011; Schneidewind, 2013). Human-induced climate change is a grand challenge for today's societies as different spheres of the natural sphere and the anthroposphere interact in a complex way (WBGU, 1996). Humans intervene in the earth's climate system (Arrhenius, 1896; IPCC, 2013), whilst the resulting changes, vice versa, affect humans and the environment on many levels. For example, the acidification and temperature rise of oceans or changes in cropping systems and food production (Cramer et al., 2014) have consequences on human societies, with impacts on human health and health determinants (WHO, 2011), etc. As a phenomenon with complex interferences between sub-spheres of the natural sphere and the anthroposphere (IPCC, 2013), climate change is an issue that demands solutions that take into account these interconnections (Woodfork and de Mulder, 2011). A focus on just the physical basis of climate change is not sufficient (Oreskes and Conway, 2014), but questions such as responsibility, justice, and values have to be integrated into the discourse on this issue (cf. WBGU, 2011; Pope Francis, 2015).

The development of new attitudes and behaviours will be necessary (Feola, 2015), as the decisions taken so far have led to the grand challenges of the 21st century, such as climate change (Steffen et al., 2015). A transformation process is needed for society to pursue sustainability and responsibility towards the environment as well as present and future generations (Bordat, 2010; Kartha et al., 2010). This will require the awareness that changes are necessary and an understanding of causes and consequences of climate change (Moser, 2010; Moser

and Dilling, 2011) as well as a greater understanding of how the different systems and spheres interconnect with each other in this context. Consequently, dealing with climate change means that one needs to think in terms of systems and between disciplines, as the topic of global climate change encompasses – amongst its physical, chemical, and biological aspects – matters with economic, social, political, and ethical dimensions (Schuler, 2011).

The young people of today will be confronted with the effects of climate change and other global challenges as the first generation to directly deal with such throughout their lives and with increasing intensity. As a very active part of our society, they will considerably shape societal transformation processes. In terms of awareness-raising, the focus should thus be on the education and preparation of adolescents as future decision-makers. Amongst other internal and external factors, such as emotions or the economic situation (Kollmuss and Agyeman, 2002), which encourage the willingness to change existing patterns of behaviour and the ability to develop new action strategies, awareness and knowledge of the existing challenges facing society (Moser, 2010) are necessary. The creation of settings in which young people have the opportunity to actively deal with climate change can serve as a basis for the development of the awareness of climate change issues and the competencies to act with regard to such.

Within the two projects *k.i.d.Z.21-kompetent in die Zukunft* and *k.i.d.Z.21-Austria*,³ such settings have been created. Both projects pursue the goal of raising young people's awareness of human-induced climate change and preparing them for this challenge. Four core ideas constitute *k.i.d.Z.21* and are an integral part of each project year:

- (i) The grand challenges of the 21st century call for cooperation between science and society (Thompson Klein et al., 2001; Pohl et al., 2008; BMWF, 2015). In a transdisciplinary approach, the teenagers and scientists from different disciplines interact in order to exchange their knowledge and perception of climate change.
- (ii) As climate change cannot be viewed from one single scientific perspective (WBGU, 1996; Woodfork and de Mulder, 2011), it is necessary to consider both scientific and humanistic aspects in an interdisciplinary learning process. Therefore, the teenagers deal with climate change from various disciplinary perspectives.
- (iii) The teenagers have the possibility to develop their own questions on climate change and actively investigate these during the project and beyond. This approach follows the idea of moderate constructivism (Duffy et al., 1993; Krüger, 2007) and meets each student wherever he or she may stand (Gerstenmaier and Mandl, 1995; Terhart, 1999).
- (iv) Complex issues such as climate change have to be made tangible in order to be understood and for action to be taken. It is thus worth visiting authentic environments to overcome the temporal and geographical discrepancy of climate change causes and consequences (Moser, 2010; Nisbet, 2009). As high mountain environments are one of the most vulnerable ecosystems rapidly responding to changing conditions, such as an increase in annual mean temperatures (Haerberli and Zumbühl, 2003), they have an indicator function for global climate change (Monreal and Stötter, 2014; Grabherr et al., 2005) and offer an authentic out-of-school learning environment (for more on the terminology

¹ The terminology regarding spheres in this study is used according to the APCC (2014). The atmosphere, hydrosphere, biosphere, and lithosphere as a whole will be referred to as the “natural sphere” herein.

² The term “anthroposphere” in this work includes sub-spheres of the socio-economic system, such as the political sphere, the economic sphere, the health system, etc., according to categories derived from the ideas of the students involved in this study.

³ “*k.i.d.Z.21-kompetent in die Zukunft*” could be translated as “*k.i.d.Z.21 – competent into the future*”.

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