



CRISES OF THE WORLD, CRISES OF THE SCIENCE EDUCATION? LET´S TAKE A CRISIS AS AN OPPORTUNITY!

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The world faces several crises in the last years. There have been more active conflicts presently than at any time since 1945. More than 82 million refugees must live away from their homes. The Covid-19 pandemic has led to a dramatic loss of human life worldwide and caused economic and social disruption, whose further consequences related to human health and further aspects of well-being can be only estimated so far. Many countries are fighting climate change for a long time and this "fight" has been disrupted by unprecedented energy crises that changes our energy goals from day to day. We are surrounded by uncertainty and worries about the future which rises of populist forces even in the democratic part of the world. So, there is no doubt that we are living through challenging times. There are many strategies for coping with these challenges, one of them is acceptance. It allows us to see reality in the present moment and to move forward. But still, there will likely be many options to choose. We believe that science education is (can become) a means for explaining possibilities and our chances. At least in some of the above crises. And sustainable development indicators with good narratives can be effective educational and information tools bringing evidence about changes in the society and environment (Janoušková et al., 2022).

Let´s start with the uncertainty regarding decrease in well-being due to an energy crisis followed by an economic crisis. We live in a culture of consumption where success is measured by prosperity - the key component is the amount of money spent for goods and services, but also other contributing factors like health and happiness. Regardless of the pretended omnipotence of humans our prosperity depends to a large extent on natural resources and the planet´s ability to cope with human interventions. The indicator Ecological Footprint shows that developed countries have already overused our finite planet -resources supporting our lives and sinks for our wastes are both damaged. Global Footprint Network, an international research organization even calculates a day when demand for ecological resources and services in a given year exceeds what Earth can regenerate in that year. This Earth Overshoot Day can be easily found for each country (Earth Overshoot day, n.d.). The "overshootday" website provides quickly accessible and very understandable information for students – they may discover and interact with data, learn about statistical trends etc. Ecological Footprint reminds students by data and facts that endless growth on a finite planet is a fiction. The coming crisis may be some limitation for humanity but also an opportunity (exploring new potentials) and very likely a positive change for the planet, including climate change (energy savings, new sources etc.).

However, this positive framework for the narrative may not be sufficient for all students. "What about my happiness?" they may ask. Of course, healthy food, appropriate cloth, nice homes, and leisure activities bring well-being up to the point. However, it has its limits - at a certain point diminishing returns set in (see e.g., Inglehart et al.,



2008; Inglehart, 2010). Happiness is a vector linked also with other aspects like maximizing free choices, democracy, tolerance, social relationships, job satisfaction, etc. In order to show students how well or poorly are nations doing at achieving long, happy, sustainable lives, the indicator Happy Planet Index can be used.

Happy Planet Index combines three elements – a country well-being multiplied by its life expectancy and divided by country's Ecological Footprint (for further information see e.g., WEAll, 2022). When we analyze the countries' ranking, we find out that none of the European countries are among the first ten countries. Another interesting finding is that the life expectancy and level of happiness in Germany (29th place) in 2019 was almost at the same level as in Costa Rica (1st place), but at the cost of far greater environmental impacts. Isn't this evidence that a happy and long life depends not only on economic prosperity but also on other aspects, such as a clean environment and *Pura Vida* – life with simplicity, optimism, and positivity?

From the point of view of science education, there is one more interesting aspect. The Happy Planet Index combines data of a subjective nature (how residents of each country rate the quality of their lives on a scale from zero to ten) with objective data (the number of years that an average person is expected to live in each country and the average impact of each resident of particular country on the environment, based on Ecological Footprint). In (natural) science we are used to work with objective data and findings, and we teach and emphasize it to students. However, to foster a broader concept of scientific thinking in students, it is desirable to point out that the social sciences work differently.

It is possible – and likely – that for some students the narratives using Ecological Footprint and Happy Planet Index data will not be sufficient arguments and they will still think of prosperity in terms of money and possessions. Hence, there can be used other – monetary – indicators. The statistical data show that one third of all the food that is produced for human consumption is wasted. Again, it may say little or nothing to some student so let's convert it to the monetary units. We may easily calculate the price of food in three shopping bags we regularly buy and imagine that we throw away one of them. Even rich people will think of such squandering, don't they?

However, the money is not the only wastage, food waste represents another cost. Food waste alone generates about 8-10% of global greenhouse gas emissions (United Nations Environment Programme, 2021) and adaptation to the climate impacts will cost money. In this regard, the World Bank's estimate suggests the necessary global infrastructure investments of \$90 trillion by 2030 and we will pay this money. This can be a strong argument for framing also other climate measures such as saving energy, water, responsible waste management, etc. For all these measures we easily find environmental and economic (monetary) indicators.

A number of requirements are placed on science education. There is a call for relating science education to everyday life; i.e., giving examples from everyday life, making computations on everyday phenomena or asking questions on how to cope with everyday problems in our personal lives or society at large (Andrée, 2005). Further, the STEAM – Science, Technology, Engineering, Technology, Arts approach in the curricula is enforced: Students should gain "hard" scientific, technological, engineering or mathematical skills and knowledge; they should find leverage both in hard and soft skills to solve problems. Some experts argue that there is appropriate teaching socio-scientific issues in science education in order to show students the whole picture of the world (Bílek, 2018). Without such an approach to science education, students – the future experts and decision-makers – can hardly understand the Sustainable Development Goals set by the United Nations. Meeting all these requirements is not straightforward and there should be more platforms like this journal for sharing good practice examples of dealing with these requirements.

Our approach is finding the ways and means for applying the sustainability concept in science education, including appropriate teacher preparation (Bílek, 2020, Janoušková & Urválková, 2022). A coherent part of it are attractive narratives to raise sentiment of various types of students. The above examples are just drops in an ocean. Nearly each producer of sustainability indicators provides us with vast amount of data in different formats and visualizations that may be used in lessons and lectures. Finding appealing and relevant narratives is a role of experts from pedagogy, didactics, psychology, and communication (besides the experts for the particular topic). Such narratives may motivate students for the pro-sustainability behavior and at the time of crises they may support positive, future-oriented thinking.

Declaration of Interest

The authors declare no competing interest.



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