

TEACHING CLIMATE CHANGES TO LIFE SCIENCES STUDENTS

R. PAȘCALĂU¹, Laura ȘMULEAC¹, S. M. STANCIU¹, L.R. STIEGELBAUER², S. LAZA DIMA², G.D. SABĂU², A. PĂDUREAN³, G. KNAP³

¹University of Life Sciences “King Mihai I” from Timișoara

²“Vasile Goldiș” Western University of Arad

³“Aurel Vlaicu” University from Arad

Corresponding author: laurasmuleac@usvt.ro

Abstract. The basic concepts of climate change include: The greenhouse effect is a natural process that occurs when certain gases in the atmosphere, such as carbon dioxide (CO₂), water vapor, and methane, trap heat from the sun, which warms the Earth's surface. Anthropogenic climate change refers to the current and ongoing changes to the Earth's climate system, largely caused by human activities, such as burning fossil fuels, deforestation, and industrial processes, which increase the amount of greenhouse gases in the atmosphere. Global warming is the ongoing increase in the Earth's average surface temperature, primarily caused by the buildup of greenhouse gases in the atmosphere. Climate feedback loops are processes in which changes in the climate system amplify or reduce the magnitude of the initial change. For example, melting polar ice caps can cause sea levels to rise, which can lead to further warming and melting of ice. Climate forcings are external factors that drive changes in the climate system, such as changes in solar radiation, volcanic eruptions, and greenhouse gas emissions. Climate sensitivity is a measure of how much the Earth's average temperature would change in response to a doubling of atmospheric CO₂ concentrations. Climate impacts refer to the effects of climate change on the environment, human societies, and economies, including changes in precipitation patterns, sea level rise, and impacts on agriculture, forestry, water resources, and human health. In conclusion, the basic concepts of climate change include the greenhouse effect, anthropogenic climate change, global warming, climate feedback loops, climate forcings, climate sensitivity, and climate impacts. Understanding these concepts is crucial to understanding the nature and causes of climate change, as well as the actions that can be taken to address the issue.

Keywords: teaching, education, climate changes, students, life sciences, environment.

INTRODUCTION

Teaching climate change to life sciences students can provide them with a comprehensive understanding of the impact of climate change on ecosystems, biodiversity, and the interconnectedness of living organisms.

The way climate change is taught is important for several reasons:

Awareness and Understanding: Effective teaching of climate change helps raise awareness and understanding among students about the causes, consequences, and complexities of this global issue. It provides them with a solid foundation of knowledge and empowers them to become informed citizens who can critically analyse information, make informed decisions, and take action (WALS, A., 2009).

Environmental Literacy: Teaching climate change fosters environmental literacy, which is crucial for individuals to understand the interconnectedness of human society and the natural world. It helps students comprehend the impact of human activities on the environment, recognize the importance of sustainable practices, and make informed choices that contribute to a more sustainable future (ROMM, J.J., 2007).

Mitigation and Adaptation: By teaching climate change, educators can inspire students to take action and contribute to climate change mitigation and adaptation efforts. Students can learn about the importance of reducing greenhouse gas emissions, transitioning to renewable energy sources, conserving natural resources, and implementing sustainable practices. They can also

develop the skills and knowledge needed to adapt to the changing climate and promote resilience in their communities.

Critical Thinking and Problem-Solving: Climate change is a complex issue that requires critical thinking and problem-solving skills. Teaching climate change encourages students to analyse scientific data, evaluate evidence, and understand the complexity of environmental challenges. It helps them develop skills such as data analysis, research interpretation, and decision-making, which are essential for addressing climate change and other pressing global issues.

Empowerment and Agency: Teaching climate change empowers students by giving them a sense of agency and the belief that they can make a positive impact. It helps them recognize that their individual and collective actions can contribute to a more sustainable future. By providing students with the knowledge, skills, and motivation to address climate change, educators enable them to become active participants in creating a more sustainable and resilient world.

Interdisciplinary Learning: Climate change is a multidisciplinary issue that spans science, social studies, ethics, economics, and more. Teaching climate change provides an opportunity for interdisciplinary learning, where students can explore connections between different subjects and understand the multifaceted nature of climate change. This interdisciplinary approach enhances their understanding of complex real-world challenges and prepares them for addressing the interconnected issues of sustainability and environmental stewardship (SCHNACK, K. BREITING, S. ROLLS, S., 2009).

Ethical Considerations and Values: Climate change education raises important ethical considerations and values related to environmental justice, equity, and intergenerational responsibility. It encourages students to reflect on their values and consider the moral dimensions of climate change, including its impact on vulnerable communities and future generations. By teaching climate change, educators can foster a sense of environmental ethics and empathy towards the natural world and diverse human populations (LOPEZ, 1998, P. 132).

How climate change is taught is important because it influences students' awareness, understanding, and engagement with this critical global issue. Effective climate change education promotes environmental literacy, critical thinking, problem-solving skills, empowerment, and interdisciplinary learning. It equips students with the knowledge, skills, and values needed to contribute to climate change mitigation, adaptation, and the creation of a more sustainable future (PAȘCALĂU AND ALL., 2020).

MATERIAL AND METHODS

In the current research the analysis method has been used, also the studies that I undertook during the last 5 years while teaching foreign languages for life sciences students, and from the analysis of the thematic workshops along the years on climate changes teaching methods.

Some specific approaches, methods and topics to be considered when teaching climate change to life sciences students, could involve:

Introduction to Climate Change: Begin by providing a clear and concise overview of climate change, including the causes, mechanisms, and global consequences. Explain the link between human activities, greenhouse gas emissions, and the Earth's changing climate patterns.

Ecological Impacts: Focus on the ecological impacts of climate change on various ecosystems, such as forests, oceans, coral reefs, and polar regions. Discuss how temperature changes, altered precipitation patterns, and rising sea levels affect species distribution, phenology, population dynamics, and ecological interactions (ȘMULEAC AND ALL., 2020).

Biodiversity Loss: Explore the relationship between climate change and biodiversity loss. Discuss how changing environmental conditions can lead to habitat degradation, range shifts, and increased extinction rates. Highlight the importance of biodiversity for ecosystem functioning and emphasize the need for conservation efforts (GUYVENCHY AND ALL, 2022).

Species Adaptation and Migration: Teach students about species' ability to adapt to changing climates through mechanisms such as phenotypic plasticity and genetic adaptation. Explore how some species may be more resilient or susceptible to climate change. Discuss the concept of species migration and its implications for ecosystem dynamics.

Impacts on Human Health: Discuss the impact of climate change on human health, emphasizing the relationship between environmental factors, infectious diseases, and public health. Explore the potential consequences of extreme weather events, changing disease vectors, food security, and access to clean water.

Climate Change Mitigation and Adaptation Strategies: Introduce students to climate change mitigation strategies, such as reducing greenhouse gas emissions, transitioning to renewable energy sources, and sustainable land management practices. Discuss the importance of international agreements like the Paris Agreement and the role of individuals, governments, and organizations in implementing these strategies. Also, highlight the importance of adaptation measures to cope with the inevitable impacts of climate change (ŞMULEAC AND ALL., 2022).

Case Studies and Research: Engage students with case studies and research findings related to climate change impacts on specific ecosystems or species. Encourage them to explore scientific literature, analyse data, and critically evaluate research methodologies. Provide opportunities for students to design and conduct their own research projects related to climate change and its ecological implications.

Field Trips and Practical Experiences: Organize field trips to local ecosystems, research institutes, or conservation centres to provide students with first hand experiences related to climate change impacts and mitigation efforts. Engage students in hands-on activities, such as data collection, ecological monitoring, or restoration projects, to enhance their understanding and connection to real-world issues.

Collaboration and Cross-disciplinary Learning: Encourage collaboration between life sciences students and students from other disciplines, such as environmental science, geography, or policy studies. Foster cross-disciplinary discussions and projects to explore the interconnectedness of environmental, social, and economic aspects of climate change (PIKE & SELBY, 1988, P. 35, ŞMULEAC, 2020, IMBREA 2011,).

Ethical Considerations and Environmental Stewardship: Promote discussions on the ethical dimensions of climate change and the responsibilities of scientists and individuals in addressing this global challenge. Encourage students to consider their role as environmental stewards and the potential for personal and collective action.

Teaching climate change to students can be done also through the following steps:

Start with the basics: Begin by explaining the basic concepts of climate change, such as the greenhouse effect, carbon emissions, and the role of human activity in causing global warming.

Use engaging and interactive activities: Engage students in interactive activities, such as group discussions, role-plays, and simulations, to help them understand the impacts of climate change and the role they can play in reducing its impact (PAŞCALĂU AND ALL., 2022).

Incorporate real-world examples: Use real-world examples to illustrate the effects of climate change, such as extreme weather events, melting polar ice caps, and changes in wildlife populations.

Use visual aids: Use visual aids, such as graphs, charts, and videos, to help students understand complex scientific concepts and to make the topic more engaging.

Encourage critical thinking: Encourage students to think critically about the causes and consequences of climate change and to consider potential solutions and actions they can take to mitigate its impact.

Foster a positive and proactive attitude: Emphasize the importance of taking positive and proactive steps to reduce the impact of climate change, such as reducing energy consumption, recycling, and supporting renewable energy.

Stay current with the latest research and information: Stay up to date with the latest research and information on climate change to ensure that students have access to the most accurate and current information.

Connect climate change to other subjects: Integrate the topic of climate change into other subjects, such as science, social studies, and geography, to provide a more comprehensive and interdisciplinary understanding of the issue.

Promote student-led projects and initiatives: Encourage students to take a proactive role in addressing climate change by leading or participating in initiatives and projects, such as planting trees, reducing waste, and advocating for environmental policies.

Encourage outdoor education: Encourage outdoor education and field trips to help students understand the impacts of climate change on the environment and wildlife (PAȘCALĂU AND ALL., 2022).

Foster a sense of global citizenship: Emphasize the global nature of climate change and the role that every individual can play in addressing the issue, regardless of their location or background.

Engage with local communities: Encourage students to engage with local communities and organizations working on environmental issues to build connections and foster a sense of community responsibility.

Use technology: Utilize technology, such as virtual reality, simulations, and online resources, to provide students with a more immersive and interactive learning experience.

Teaching climate change to students involves a variety of approaches and activities, including connecting it to other subjects, promoting student-led projects, encouraging outdoor education, fostering a sense of global citizenship, engaging with local communities, and utilizing technology. These approaches can help students understand the impacts of climate change, develop critical thinking skills, and take action to reduce its impact (ȘMULEAC AND ALL., 2013). By incorporating these approaches, methods and topics, educators can provide life sciences students with a comprehensive understanding of climate change and its ecological implications. Equipped with this knowledge, students can contribute to scientific research, conservation efforts, and informed decision-making to mitigate and adapt to climate change's impacts on biodiversity and ecosystems.

RESULTS AND DISCUSSIONS

Some major results in teaching climate changes to life sciences students would be considered of high priority because they include:

Relevance to current and future global challenges: Climate change is one of the biggest challenges facing humanity today and will continue to impact the world in the future, so it is important for students to understand the causes, consequences, and potential solutions to the issue (PAȘCALĂU AND ALL., 2021).

Enhancement of critical thinking and problem-solving skills: Studying climate change can help students develop critical thinking and problem-solving skills, as they analyse complex systems and consider potential solutions to the issue.

Increase of scientific literacy: Understanding climate change requires an understanding of basic scientific principles, such as the Earth's climate system, the greenhouse effect, and the role of human activities in changing the climate and develop a deeper understanding of the Earth's climate system.

Promotion of environmental awareness and action: Studying climate change can help students understand the importance of environmental protection and encourage them to take action to reduce their own carbon footprint and advocate for policies to address the issue.

Support of interdisciplinary learning: Climate change is a complex issue that spans multiple disciplines, including science, economics, politics, and sociology. Studying climate change in class provides students with a cross-disciplinary understanding of the issue (KAGAWA, F. & SELBY, D., 2010).

Relevance to real-world issues: Climate change has real-world impacts on people, wildlife, and ecosystems, and studying the issue can help students understand how their actions and decisions can affect the world around them.

Career opportunities: As the world increasingly focuses on addressing the issue of climate change, studying the issue can provide students with valuable knowledge and skills that can be applied to a wide range of careers in fields such as science, policy, sustainability, and renewable energy.

The results of studying climate change can include increased scientific literacy, improved critical thinking and problem-solving skills, increased environmental awareness and activism, interdisciplinary understanding, relevance to real-world issues, and potential career opportunities.

CONCLUSIONS

In conclusion, the study of climate change is important for students as it provides them with a deeper understanding of the basic scientific principles behind the issue, as well as the economic, political, and social dimensions of the problem. Studying climate change can help students develop critical thinking and problem-solving skills, increase their environmental awareness and activism, and prepare them for careers in fields related to climate change and sustainability. By gaining a cross-disciplinary understanding of the issue, students can become informed and engaged citizens who are well-equipped to address the challenges of climate change in the future.

In addition to the benefits outlined above, studying climate change can also help students develop a sense of global citizenship and an understanding of their role in addressing the issue. Climate change is a global problem that affects all countries and communities, and students can learn about the ways in which different regions and cultures are affected and how they can work together to address the issue. Moreover, studying climate change can provide students with a comprehensive understanding of the relationship between human activities and the natural world, including the ways in which human activities such as burning fossil fuels and deforestation contribute to the issue. By learning about the impacts of climate change on natural systems and human communities, students can understand the importance of taking action to reduce their own carbon footprint and advocate for policies that address the issue. Studying climate change can also help students develop their ability to use data, analyse information, and evaluate sources, as they learn about the scientific evidence and data related

to the issue. This can help prepare students for further studies and careers in science and related fields, where these skills will be valuable.

Finally, by engaging in discussions and debates about climate change, students can develop their communication skills, work collaboratively with others, and participate in informed and respectful conversations about a complex and important global issue.

In conclusion, studying climate change provides students with a range of benefits, including increased scientific literacy, improved critical thinking and problem-solving skills, increased environmental awareness and activism, interdisciplinary understanding, relevance to real-world issues, career opportunities, global citizenship, and opportunities for developing important skills such as data analysis and communication. Teaching climate change to students requires a combination of engaging and interactive activities, real-world examples, visual aids, critical thinking, and a positive and proactive attitude, as well as staying up to date with the latest research and information.

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