Pedagogical Model for Teacher Education on Climate Change

Olivia LEVRINI (1), Giulia TASQUIER (1), Eleonora BARELLI (1), Emma D'ORTO (1), Clemente ROSSI (1), Dimitris STAVROU (2), Emily MICHAILIDI (2), Ioannis METAXAS (2), Laura RIUTTANEN (3), Jari LAVONEN (3), Katja LAURI (3), Suvi LINTUVAARA (3), Janina TAURINEN (3), Athina GINOUDI (4), Thalia TSAKNIA (5), Giorgia BELLENTANI (6), Francesco MARTINELLI (6), Stefania ZAMPETTI (6), Nikos KALIVITIS (2), Maria KANAKIDOU (2)

(1) Department of Physics and Astronomy "A. Righi", University of Bologna Via Irnerio 46, 40126, Bologna, Italy
(2) University of Crete, Gallos University Campus,74100, Rethymnon, Greece
(3) University of Helsinki, PL 4 (Yliopistonkatu 3), 00014 University of Helsinki, Finland
(4) Regional Directorate of Primary and Secondary Education of Crete, Knosou Av. 6, 71306, Heraklion, Greece
(5) Ellinogermaniki Agogi, Dimitriou Panagea Str. 153 51, Pallini Attikis, Greece
(6) Fondazione Golinelli, Via Paolo Nanni Costa, 14, 40133 Bologna, Italy

Abstract. In the contribution we present the pedagogical model developed within the Erasmus+ Teacher Academy called CLIMADEMY, coordinated by the University of Crete (https://climademy.eu/). In the project, a comprehensive training framework for in-service and pre-service teachers has been developed to support them in understanding Climate Change drivers and impacts, mitigation and adaptation actions, and to promote their efficiency in teaching and learning about Climate Change. The pedagogical model was built to align policy documents, school constraints, teacher needs and to pursue the goal of generating a new school eco-system through the creation of inter-transdisciplinary boundary zones.

Introduction

Education for young people is stressed as one of the most effective tools for combating climate change [1]. Despite the increasing interest in climate change education by policymakers, the research community, and educational stakeholders, teacher education remains an open and complex problem, also because teachers are typically formed within disciplinary educational paths. Urgent problems are: *What type of materials and educational support do secondary school teachers need to incorporate climate change in their teaching? What challenges does climate change education pose to science teachers and the current school ecosystem? What type of institutional, disciplinary, epistemological, and relational transformations are needed to include climate change in school curriculum and, hence, in teacher education?*

These questions are the core of CLIMADEMY, an Erasmus + project, whose aim is to offer a comprehensive training framework for teacher education on climate change, its drivers, impacts and mitigation options. The consortium is comprised of seven partners from four countries: the Universities of Crete (coordinators: Maria Kanakidou and Nikos Kalivitis), Bologna, Bremen, Helsinki, the Regional Directorate of Primary and Secondary Education of Crete, the Greekgerman education school, and Fondazione Golinelli.

The contribution to WCPE will focus on one outcome of the project: the pedagogical model that has been developed to address teachers' needs and to position the CLIMADEMY with respect to the above questions.

Research question, methods, and theoretical frameworks

What are teachers' needs and how can they be addressed? In order to answer these research questions, a qualitative survey (based on focus groups) on the needs of 41 teachers or student-teachers involved in the four hubs of the project has been carried out [2]. The needs have been organized in: disciplinary (the need to enrich and improve their knowledge and re-define their sense of their expertise); educational practical (the need to have concrete but flexible and open-ended resources); orienteering (the need to have goals and shared values to get oriented in their choices), institutional (the need to have a supportive and society-responsive school system). The results have oriented the design of the pedagogical model, targeted to teacher trainers. The model was built by combining different theoretical frameworks of science education research. The Model of Educational Reconstruction [3], together with a modified Content Representation [4], was used to analyse and design activities to frame the disciplinary need. The GreenComp framework [5] was analysed to develop the CLIMADEMY competence framework and used to respond to the orienteering need. The construct of participant frameworks, the MERID model for mentoring [6] and assessment references [7] have been used to address the educational practical need. Models of open-schooling [8] were used to image institutional changes.

Findings and conclusions

The pedagogical model is a comprehensive document articulated into: a) Guidelines for designing and implementing teacher training activities (including recommendations to analyse scientific contents, the CLIMADEMY competence framework, pedagogical principles, assessment references); b) Template for Instruction activities and prototypes of activities; c) Assessment tools: further guidelines and examples.

The pedagogical model of CLIMADEMY and the process through which it was developed can offer the WCPE participants an example of how physics education research was exploited to align policy documents, school constraints, and teacher needs and to pursue the goal to generate a new school ecosystem through the creation of inter-transdisciplinary boundary zones.

References

[1] EUROPARL (2019) https://www.europarl.europa.eu/doceo/document/TA-8-2019-0217_EN.html

[2] C. Rossi, Pedagogical model for teacher education on climate change within the European CLIMADEMY project. Master Dissertation Thesis. University of Bologna, 2023.

[3] R. Duit, H. Gropengießer, U. Kattmann, M. Komorek, I. Parchmann, The Model of Educational Reconstruction – A framework for improving teaching and learning science. In D. Jorde & J. Dillon (Eds.), *The World of Science Education: Science Education Research and Practice in Europe* (pp.13-37). Rotterdam: Sense Publishers, 2012.

[4] J. Loughran, P. Mulhall, A. Berry, Exploring pedagogical content knowledge in science teacher education, *International Journal of Science Education* **30**(10) (2008) 1301–1320.

[5] G. Bianchi, U. Pisiotis, M. Cabrera Giraldez, *GreenComp – The European sustainability competence framework*. Publications Office of the European Union, Luxembourg, 2022. https://doi.org/10.2760/13286, JRC128040.

[6] E. Michailidi, D. Stavrou, Mentoring in-service teachers on implementing innovative teaching modules, *Teaching and Teacher Education* **105** (2021) 103414.

[7] J. H. McMillan (ed.) *Handbook of Research on Classroom Assessment*, SAGE, 2023.

[8] G. Tasquier, O. Levrini, A. Laherto, T. Rasa, J. Chan, L. Hyyppä, S. Satanassi, (2023). *Model for science education for the society of acceleration and uncertainty*, Deliverable 4.4, 2023. https://doi.org/10.5281/zenodo.10048031