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A CLIMATE CHANGE TECHNOLOGY ENHANCED CURRICULUM FOR TEACHING PRESERVICE TEACHERS[6]

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Abstract: *The education system is one of the fundamental means used to form the society's worldview. Global problems such as climate change, biodiversity decrease, social inequalities, and tensions, are systemic challenges in which education has a key role to play. The ability of teachers to influence the worldview of their students strongly depends on their qualification as well as their own character and values. The project TECCHED is aimed at developing technology-enhanced climate change educational resources, that could support the education of preservice teachers. This study aims to present a curriculum, which promotes the values and character concerning ecological worldview, socioscientific accountability, social and moral compassion and encouraging active participation in mitigation of climate change.*

Keywords: *climate change, curriculum, character and values, technology enhanced, project TECCHED*
JEL Codes: *I20, I21*

INTRODUCTION

Climate change (CC) is arguably one of the most pressing issues faced by our society today. Its effects are far-reaching and will surely impact the quality of life of the current population and the lives of generations to come. This justifies the need to accept the existing facts, and at the same time- to benefit from existing technological achievements and to create new ways of tackling global challenges. The participation of the society is crucial for ensuring sustainable development of the local community, which means that appropriate knowledge and competences must be acquired to implement CC education (Reid, 2019).

Climate change is an issue that affects all living species on the Earth. Education plays a pivotal role to turn around the negative trends, and to influence civic participation and activity. Two of the United Nations Sustainable Development Goals (UN SDGs) are the most closely related to 2 of the 17 SDGs:

- SDG 4 "Quality Education": Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all (UN SDGs, 2023); and

- SDG 13 “Climate Action”: Take urgent action to combat climate change and its impacts (UN SDGs, 2023).

Some authors (Tolppanen et al., 2022) claim that a positive change can be brought about by:

- Increasing knowledge;
- Advancing thinking skills;
- Addressing values and worldviews;
- Motivating preservice teachers to act, address emotions, create future scenarios of what the world should like and address the barriers to CC mitigation.

At the same time, this is happening in a complex context, in which the responsibility of government and business owners is of paramount importance (Tolppanen, & Kärkkäinen, 2021):

- Knowledge about CC is influenced by the media, because of which students have different knowledge when starting their studies;
- Complexity of science, as CC is an invisible phenomenon that cannot be observed in the short term;
- Social aspects, because CC affects people's lives in different regions, each of which has its own topical problems that are of no interest to residents of other regions. (Tolppanen, & Aksela, 2018).

Pearson et al. (2023) see the solution in the active involvement of preservice teachers by integrating moral, civic and character education into science education, especially about CC.
In this paper are presented some results from the TECCHED project, aimed at developing a climate-change curriculum for pre-service teachers.

EXPOSITION

General info about the project

The Erasmus+ Project “Designing a Technology-enhanced Climate Change Education Curriculum” (TECCHED) (Project № 2022-1-BG01-KA220-HED-000088178) aims to design and implement a technology-supported climate change curriculum for teacher education programs that foster the development of character and values for 21st century responsible citizenry. The objectives are designing a curriculum for technology-supported climate change that fosters character and values in teacher education programs, an enriched book, a digital learning platform, and implementing and evaluating the effectiveness of the curriculum and digital learning platform.
The project coordinator is the University of Ruse “Angel Kanchev”, and the other members of the consortium come from Belgium, Spain, Latvia, and Türkiye (Fig. 1). The geographical balance enables an all-around view of climate-relates issues and solutions.
Some of the key expected impacts of the TECCHED Project (TECCHED Project website, 2023) are:

- A technology-supported climate change curriculum for teacher education programs aiming at fostering character and values development;
- A technology-supported climate change enriched book;
- A digital learning platform for educators.

These resources will aim at an increased level of Technological Pedagogical Content Knowledge (TPACK) self-efficacies, cognitive structures about teaching climate change (Lee et al., 2012; Lee et al., 2013), improved views of faculty members on the roles of character and values in teaching climate change.

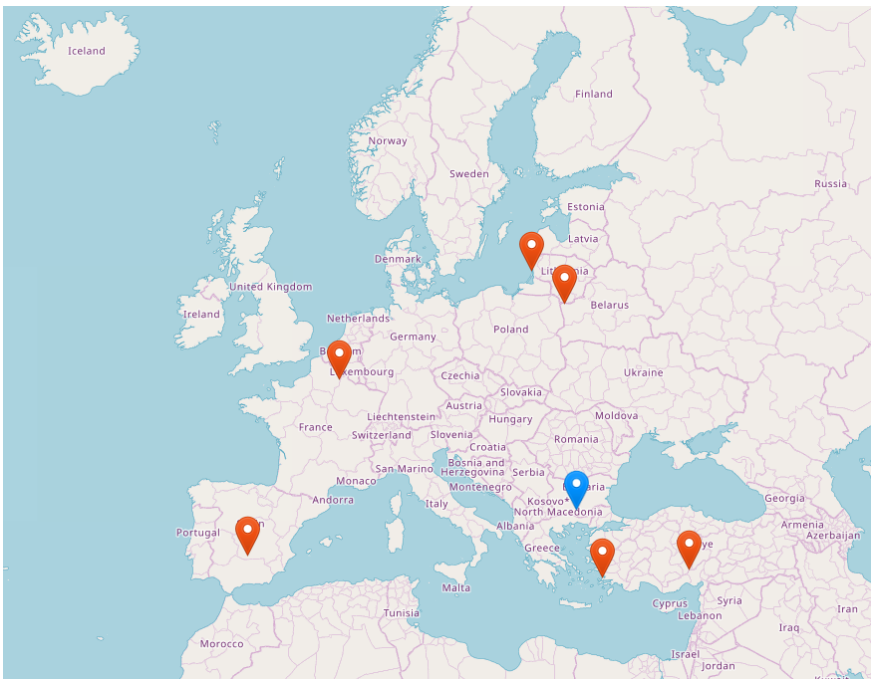

Fig. 1. Project consortium (Erasmus+, 2023).

According to the project proposal, the TECCHED curriculum is proposed jointly by EGE University and Liepaja University. This output contains the following structural elements:

- Climate Change Education;
- Technology Enhanced Learning in Climate Change Education;
- Character and Values in Socioscientific Issue-based Teaching & Learning;
- Purpose of the Curriculum;
- Learning Outcomes of the Curriculum;
- Curriculum;
- References.

Preliminary analysis

The TECCHED Needs Analysis performed by the partners in the consortium reveals that CC is an important topic and needs to be communicated to all society (Phun et al., 2020; Topp et al., 2019). Teaching about CC is most frequently supported by:

- Web-based platforms;
- Mobile applications;
- Online courses.

Character and values are the two factors that serve as general points of reference for individuals to support decision-making and to act responsibly regarding CC. The dimension of character and values includes three key elements (Lee et al., 2012; 2013): ecological worldview, social and moral compassion, and socioscientific accountability.

The TECCHED Needs Analysis concludes that more than half of preservice teachers feel responsible, understand their role and are ready to take the action regarding CC.

The developed curriculum

The overall purpose of the TECCHED curriculum is to implement a technology-enhanced climate change education curriculum by promoting the awareness of preservice teachers of the values and character concerning ecological worldview, socioscientific accountability, social and moral compassion

and encouraging active participation in mitigation of CC. Considering that teachers are often perceived as role models by their students, the TECCHED curriculum relies that its effects will be long-terms and sustainable when the preservice teachers receive proper training.

The learning outcomes of the curriculum envisioned by the project consortium are multi-faceted. Still, they can be distilled to the following mutually supporting elements in respect to the competencies of preservice teachers:

- To know the conceptual and methodological basis and relevance of CC education;
- To analyse and critically evaluate the challenges, achievements, and relevance of CC in pedagogical process as a basis for knowledge transfer into different social environments;
- To create networks and communities to promote the development of knowledge, skills, and competences in the field of CC;
- To participate responsibly and ethically in the local, national, and global community to build a sustainable future.

The TECCHED Curriculum covers 14 weeks and 2 teaching hours per week. The idea is that the course will be elective and will target bachelor's degree students. The full curriculum also specifies such details as: course objectives, prerequisites, delivery approach, assessment, and grade distribution.

The curriculum encompasses 4 competence domains, containing the following CC topics:

- *Content Knowledge*: climate and weather, greenhouse gasses, greenhouse effect, carbon cycle, climate scenarios, evolution of the Earth, etc.;
- *Causes of Change*: carbon footprint and personal lifestyle choices, deforestation, industrial choices and initiatives, energy systems, etc.;
- *Effects of Change*: extreme weather events, damages on infrastructure, power supplies, biodiversity loss, moral and ethical sensitivity, melting of glaciers, sea level rise, droughts, food insufficiency and immigration, human health, etc.;
- *Mitigation and adaptation*: sustainable transportation and agriculture, diet, consumption, recycling, lifestyle preferences, policy measures, environmental communication, etc.

Specific objectives are outlined for all of the abovementioned competence domains and topics that comprise the TECCHED curriculum.

CONCLUSION

The world today is facing pressing problems. Educators are responsible for promoting knowledge and awareness of climate change. Climate education has to be integrated into the curriculum.
A possible solution proposed by a multinational team of experts is the technology-supported climate change curriculum for teacher education programs, developed as one of the key results of the TECCHED project.
It will serve as a basis for creating the technology-supported climate change enriched book, and the digital learning platform for educators. The expected impactful outcomes are foreseen in the improved views of faculty members on the roles of character and values in teaching climate change, thus influencing the mindset of future preservice teachers and their students.

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REFERENCES

Erasmus+. Designing a Technology-enhanced Climate Change Education Curriculum. Project webpage. (2023). https://erasmus-plus.ec.europa.eu/projects/search/details/2022-1-BG01-KA220-HED-000088178.

Lee, H., Chang, H., Choi, K., Kim, S. W., & Zeidler, D. L. (2012). Developing character and values for global citizens: Analysis of pre-service science teachers' moral reasoning on socioscientific issues. International Journal of Science Education, 34(6), 925-953.

Lee, H., Yoo, J., Choi, K., Kim, S. W., Krajcik, J., Herman, B. C., & Zeidler, D. L. (2013). Socioscientific issues as a vehicle for promoting character and values for global citizens. International Journal of Science Education, 35(12), 2079-2113.

Pearson, A. R., Tsai, C. G., & Clayton, S. (2021). Ethics, morality, and the psychology of climate justice. Current Opinion in Psychology, 42, 36-42

Phun, Y. et al. (2020). Disruptive education based on action characterizing eco-environmental variables to mitigate global warming. Procedia Computer Science, V. 172, 979-984.

Reid, A. (2019). Climate change education and research: possibilities and potentials versus problems and perils? Environmental Education Research, 25(6), 767–790, https://doi.org/10.1080/13504622.2019.1664075.

TECCHED Project Website. (2023). https://tecched.eu/.

Tolppanen, S., & Aksela, M. (2018). Identifying and addressing students' questions on climate change. The Journal of Environmental Education, 49(5), 375-389.

Tolppanen, S., Kang, J., & Riuttanen, L. (2022). Changes in students' knowledge, values, worldview, and willingness to take mitigative climate action after attending a course on holistic climate change education. Journal of Cleaner Production, 373, 133865.

Tolppanen, S., & Kärkkäinen, S. (2021). The blame-game: pre-service teachers' views on who is responsible and what needs to be done to mitigate climate change. International Journal of Science Education, 43(14), 2402-2425.

Topp, K., Thai, M., Hryciw, D.H. (2019). The role of entertainment in engagement with climate change. Environmental Education Research, Vol. 25. DOI: https://doi.org/10.1080/13504622.2019.1572072.

United Nations (2023). Sustainable Development Goals. Goal 4 "Quality Education". https://sdgs.un.org/goals/goal4.

United Nations (2023). Sustainable Development Goals. Goal 13 "Climate Action". https://sdgs.un.org/goals/goal13.