

Reviewer's comments are in black, followed by authors' replies in blue.

This manuscript addresses a relevant topic within the scope of GC, namely the design and delivery of interdisciplinary master's-level education in climate services. The paper presents a potentially valuable case study and contributes to ongoing discussions on climate literacy and capacity building. The topic is timely, and the manuscript provides useful insights into the development of a new educational approach.

We thank the reviewer for the valuable and constructive comments. We greatly appreciate the time and effort invested in reviewing our manuscript and we are pleased that the relevance of the topic and the usefulness of the paper is recognized. We will carefully consider all the suggestions provided and revise the manuscript accordingly to improve the clarity and overall quality of the manuscript.

At the same time, the manuscript currently reads more as a project report than as a scientific article. Considerable shortening and sharpening would improve its suitability for publication. Several sections contain repetitive descriptions of the course development process, while the key findings and their implications could be presented more clearly.

Thank you for pointing this out. Similar concerns were also raised by Referee #1 and we will revise the manuscript to improve the scientific focus and shorten it by reducing descriptive overlap, especially in Section 2 (Course development and piloting). We will strengthen the analytical framing of the design-based research approach and improve the presentation of findings by explicitly discussing the new knowledge outcomes generated based on the collected evidence during and after the first pilot.

A further limitation is that the evaluation is based on a relatively small sample and focuses on the piloting phase of the course. The manuscript does not provide an assessment of the final course implementation or its impact on climate literacy, which could be the most valuable contribution for readers. While pilot evaluations are informative, the absence of evidence regarding the effectiveness of the final course limits the strength of the conclusions that can be drawn.

We acknowledge that the relatively small sample and the lack of information on effectiveness of final course implementation is a limitation of the study. While Section 3.3 describes the improvements made to the course content, assignments, real-life project and scheduling based on participant feedback and the pilot evaluation, the implementation and outcomes of the finalized course have not yet been presented. To address this limitation, we will include a short description of the final course implementation and the feedback received, and indications of its contribution to students' climate literacy. In addition, we will provide information on the longer-term adoption and

sustainability of the course. Following the pilot phase, the course has become an established component of the Master's Programme in Meteorology, Atmospheric and Climate-System Sciences and has been offered annually. Since its introduction, approximately 100 students have enrolled in and successfully completed the course during this period. Notably, it is the only course within the curriculum that engages students in a real-life climate service project having a concrete target of a customer, providing a unique opportunity to apply their knowledge to a concrete stakeholder need.

Specific comments

Clarity regarding the course ambitions and target audience. The manuscript would benefit from a clearer description of the intended audience and educational objectives of the course. The course is described as "transdisciplinary" and "to build the climate competency of society". However, the prerequisite knowledge requirements, including prior completion of climate-related university courses and familiarity with "climate physics equations", appear to set a relatively narrow entry threshold.

This raises questions regarding the extent to which the course is accessible to students from diverse disciplinary backgrounds. The distinction between interdisciplinary and transdisciplinary education could also be discussed more carefully. In particular, transdisciplinary approaches imply collaboration among individuals with complementary expertise (including non-academic) rather than requiring students to possess substantial prior knowledge across multiple disciplines.

We thank the referee for this constructive feedback and acknowledge that the intended audience could be described more clearly. As part of the Climate University curriculum, the "Living with Changing Climate" course is open to university students from all disciplines. Although two climate-related courses are recommended as prerequisites, their completion is not mandatory for enrollment and thus don't necessarily narrow the variety of students enrolled. Consequently, students may enter the course with highly diverse academic backgrounds and varying levels of prior knowledge. This diversity was a key consideration in both the initial course design and the subsequent refinement following the pilot phase. To support learners with different levels of expertise, the course incorporates layered learning materials and assignments, as well as optional material covering basic statistical concepts, as discussed in Section 4.3. We will clarify this aspect further in Section 2.2 Designing and producing the course content.

We also acknowledge that, although the objectives of the course are listed in detail as learning outcomes in Supplement 1, they are not sufficiently emphasized in the main text. Therefore, in the revised manuscript we will make the educational objectives more explicit by revising the paragraph in Section 2.2, as follows:

"The primary objective of the course was to develop students' capacity for climate-informed decision-making, to equip students with the knowledge and skills needed to utilize open climate and weather data in addressing real-life climate challenges and to strengthen their ability to

contribute to climate adaptation and mitigation actions in professional contexts and thereby to build the climate competence of society (see Supplement 1 for detailed learning outcomes). In addition, a central objective was to bridge scientific understanding and practical application by introducing students to the principles of climate services and user-oriented, co-design approaches.

To achieve these objectives, the course provided students with an understanding of 1) the causes and complexity of climate change, 2) the variability and regionality of climate change impacts, adaptation needs, unavoidable loss and damage, main uncertainties (such as tipping points), and future scenarios and their links to mitigation efforts, 3) available data (e.g., reanalyses, observations, and data from coordinated global and regional climate model experiments) and applications (e.g., the WMO Climate Atlas and C3S applications) and how these can be used in problem solving, and 4) the principles of climate services with emphasis on stakeholder engagement and co-design. Additionally, the course sought to familiarize students with real-life actions and action gaps in climate change adaptation and mitigation in both private companies and public organizations, and to co-create a climate service addressing a concrete user need.”

Finally, we will revise the use of the term transdisciplinary education to improve conceptual clarity. We will make clear that transdisciplinarity is operationalized through collaborative learning, stakeholder engagement and the integration of perspectives from different expertise. It does not imply that all students are expected to achieve expertise across multiple disciplines.

The co-development process. The manuscript would benefit from greater clarity regarding the design process. Since feedback from teachers is discussed during the pilot phase, it would be useful to clarify whether these teachers, or other educational experts, were also involved in the initial course co-design and development.

We will revise the description of the development process and clarify the role of educational experts, scientists and teachers in co-design approach. We will specify the roles of educational scientists and curriculum design experts in early phases, including the ABC workshop and design meetings. We will also clarify in Section 3 (Evaluation of the piloted course) that teachers involved in the pilot phase were active participants in the co-design process, ensuring continuity between design and implementation. In addition, education experts contributed to the analysis of feedback and participated in identifying and prioritizing the improvements made to the course.

Evaluation of the pilot phase. One significant aspect that is not addressed in the manuscript is the high dropout rate during the pilot. According to the manuscript, only one-third of the enrolled students completed the course. Understanding the reasons behind this dropout could provide important insights for future course development. The current evaluation is based on eight learning diaries and seven questionnaire responses from students who completed the course. Were any

efforts made to collect feedback from students who discontinued participation? Information on challenges or reasons for withdrawal could be very informative and might represent one of the most valuable outcomes of the pilot evaluation.

We agree that the high dropout is a significant aspect of the study and will address it more explicitly in the revised manuscript. We will discuss the likely contributing factors based on available evidence. Although no systematic data was collected from students who withdrew from the course, which we now explicitly acknowledge as a limitation, we received informal feedback from several students who dropped out during the pilot. According to this feedback, the main reasons for withdrawal included a heavy workload, a high number of assignments, some of which required pre-knowledge, and changed personal circumstances, such as managing multiple course enrollments simultaneously. In addition, two of the 27 students enrolled in the pilot participated actively in the course but did not complete the final examination. The academic backgrounds of the students who withdrew were diverse, including both natural sciences and communication, suggesting that attrition was not limited to a particular disciplinary group. All the feedback received from these students regarding the course difficulty and workload was taken into account when improving the course. It is also noteworthy that the dropout rate was considerably lower in the final course implementation. Of the 37 students enrolled, 30 completed the course, indicating a substantial improvement in student retention following the revisions made after the pilot phase.

Lessons learned and conclusions. The three lessons learned presented in the manuscript are relevant but remain rather general and appear to derive primarily from observations made during the course design process. Given that the manuscript does not assess the implementation or outcomes of the final course, the conclusions should be framed more cautiously. It would be helpful to distinguish more clearly between lessons derived from course development and lessons supported by empirical evaluation of student experiences and learning outcomes.

We thank the reviewer for this important comment. To address this, we will revise Section 4 to frame the discussion and conclusions more clearly and avoid overgeneralization. Specifically, we will discuss the lessons learned from course design and pilot and the new knowledge outcomes identified from the empirical evidence collected during and after the pilot phase (i.e. students' feedback, learning diaries, teachers' reflections). The revised section will also address the limitations of reporting on the first pilot cycle and need of further study to evaluate the effectiveness of the implemented final course.