Author Response to Reviews of

Hello world! An interdisciplinary climate modelling course

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RC: ***Reviewer Comment***, AR: *Author Response*, ☐ Manuscript text

1. Reviewer #1

RC: ***In the article "Hello world! Teaching an interdisciplinary understanding of climate modelling", the authors present a course developed for high-school students to introduce the technical and social considerations of climate modelling. They share learnings from the course organizers as well as from the students throughout the development process. As such, this article offers interesting insights into the considerations of designing an interdisciplinary course.***

The authors do a great job in transparently sharing the intentions and potential biases that possibly affected the design and evaluation of the course. The article is well and comprehensively written but could benefit from some additional elaborations and reorganization in the methods and result section. Additionally, there are couple of minor aspects I would suggest to address to further enhance the flow and clarity of this interesting article:

AR: *Thank you for your thorough reading and suggestions that greatly enhance the clarity of our article.*

Title

RC: ***I am wondering if the title of this article is capturing the essence of the article which seems less on the teaching process than the outline/structure of the course and the learnings by the students.***

AR: *Thank you for this suggestion. We have changed the title to "Hello World! An interdisciplinary climate modelling course" to make it more clear that the article gives an overview over the course contents and less about the teaching process.*

l.4

RC: ***worth mentioning the number of hours the course is designed for?***

AR: *Thank you for that practical suggestion. We have added in the abstract:*

> Following a design-based research approach, this study develops a 50 hour long course at Bachelor level that aims to teach students such interdisciplinary perspectives.

l.25

RC: ***the citation format seems incorrect (Ward (2021)..). Please correct throughout the article.***

AR: *Thanks, we have corrected this throughout.*

l.44

RC: ***It would be interesting to briefly reflect on the gap of such courses that combine the development aspects with critical thinking. I could imagine that there are couple of initiatives out there trying to address the gap the authors have argued.***

AR: *It's always difficult to argue for a gap. Also with some renewed literature search we could find literature on*

- *interdisciplinarity in geoscience education more generally (for example Cumiskey et al., 2019; Siponen et al., 2025)*
- *transdisciplinary in climate change education (for example Vajda et al., 2026)*
- *STS teaching (York et al., forthcoming, for example)*
- *critical thinking and modeling, where modeling is seen broadly as a competency (Gómiz-Aragón et al., 2025)*

but not courses on climate or geoscientific modeling in combination with critical thinking. We think that this is because learning about climate modeling happens either in geoscientific university education that is siloed, or only as background knowledge for understanding climate change.

l.46

RC: ***the period mentioned here is a bit confusing. In the methodology, the authors mention that the final evaluation of the course by means of the open reflection is done in 2024. But here the authors mention that the course has been taught 4 times. Even though that might be factually correct, I wonder if that is relevant for the purpose of this study which has the focus of reflecting on the learning process of students and the development of a course combining climate model development with critical thinking.***

AR: *We understand this could be confusing and have clarified 2024 in the introduction now.*

> The current study presents an interdisciplinary course on climate modeling, called "`Hello world!` From numerical programming to complex climate models", ~~and which~~ as we have taught ~~4 times (2022 - 2025). To our knowledge a course like this has not been documented in the literature before, and thus this study contributes to a generally small base of literature that explicitly treats the teaching of climate modeling.~~ it in 2024.

Also see l. 243ff: this seems to be a sentence that could be well suited in the conclusion as an outlook, while keeping the main focus of the study on the period until 2024.

AR: *We have moved this small paragraph to the conclusions, as you suggested. Note that we have also clarified the four years that the course took place in the beginning of Sec. 3.2 now.*

> Each of the ~~three~~ four years that we taught the course (2022 – 2025) offered an opportunity for improvement, based on our own experiences and students' feedback.

Figure 1

RC: ***I wonder if it could be useful to number the different themes in order of how approached in the course to improve the sequential logic in a figure which cannot just be read left > right, top > bottom? Check spelling errors (e.g. Dscretization)***

AR: *To help the readability of the Figure, we have added the numbering and highlighted the arrows that were meant for that in bold. We have added an explanatory sentence in the caption to make clear that the numbers do not refer to a sequential logic in the course structure as that became more integrated and increasingly deviated from a consecutive approach. The caption of Figure 1 reads now in full:*

> Content of the course, divided by the four ~~themes~~ topic groups or aims of the course (colors). The content builds up from bottom to top in principal, as indicated by the arrows and numbering in **a)**, but as we detail in Sec. 3.2, we integrated the content more and more to have the understanding of the numerical modeling and the philosophical perspectives and science and technology studies (STS) content benefit each other, as evident in the chronological course structure detailed in **b)**. The reflective exercises are indicated in **b)**, and they each covered all the modules treated before each exercises. Each of the three rounds included the "a posteriori" and the "a priori" question and the analysis in Sec. 3 treats all three rounds of the exercises at the same time. The colors correspond roughly to the ones used to illustrate the content analysis results in Fig. 3. For the detailed course structure, see Table A1. The sketch is based on Corona Bustamante (1860).

Also, the spelling errors have been corrected.

l.55-57

RC: ***these lines seem repetitive, especially since similar information is shared just a couple lines later (l. 63-65).***

We have removed the duplication and restructured what remained in the last part of the introduction.

l.65

RC: ***The last piece of information the authors shared was that they taught the course four times. But now they only mention information regarding the 2024 course edition. This either needs to be justified better or captured more broadly. As the authors mention the iterative design process, it might be interesting to mention the numbers of the other years too.***

AR: *Following your above suggestion (l. 46), this inconsistency is resolved now. We first mention the four iterations of the course in Sec. 2.1 now, where they are relevant for the design process, as you suggested.*

l.65

RC: ***apart from mixed gender, does age also play a role?***

AR: *For data protection reasons, the NAka team is unable to provide the age of our course participants. However, we have added the general age bracket of the NAka students:*

> In total, around 100 students take part in the NAka program each year, aged between 15 and 18, and they are distributed over six courses.

l.63ff

RC: ***A complaint on high level, but I am wondering if the section would benefit from some reorganization. As it reads now, information about the general context of the academy and the specifics of the course(s) subject to this article is quite intertwined (e.g. l.64-65), limitations and ethical considerations are spread across the section (e.g. l. 69-70; l.79-80; l.154-155). An approach could be to be a bit more concise regarding the boundary conditions the academy offers followed by a more elaborate introduction to the course specifics.***

AR: *Thank you for the suggestion! We have restructured the beginning of the Methods section as you suggest, with context about the academy before course specifics. Also note the new Sec. 3.4 where we grouped caveats and limitations together, also in response to reviewer # 2.*

l.130ff

RC: ***Did the authors also describe the method that led to the generation of figure 3? That seemed to be an additional reflection before / at the end of the course which is different from the module-related reflections?***

AR: *Fig. 3 emerged from the coding of the same three reflective exercises as Fig. 2, but with a focus on the contrast between "a priori" and "a posteriori" answers. We have added explanatory notes to the captions of Fig. 2 and 3.*

> See Fig. 3 for codes that specifically treat the "a priori" and "a posteriori" content of the exercises.

> **Figure 3.** Codes that emerged from the content analysis of the students' three reflective ~~exercise~~exercises (see Fig. 1 b), specifically regarding what they answered as concepts and thoughts they had a) "a priori" the course or course module and b) "a posteriori" the course module. Fig. 2 treats the topics brought up in the exercises more generally.

l.145

RC: ***It is unclear what the authors mean by assessment cycle. Do they mean the different link to one of the modules?***

AR: *We meant the different rounds of the reflective exercise, but since we don't distinguish between in the following and in the Figures, we deleted the mention here.*

A bit later the authors talk about pre-existing labels. Which ones do they mean?

AR: *You're right, this naming is confusing. We meant the codes that the first author made (and that were thus existing for the second) and have clarified this:*

> After coding was completed by the first author of this paper, the second author went through 17 randomly sampled quotations and assigned the ~~pre-existing~~ first author's codes to them.

l.145ff

RC: ***I find this elaboration on the calibration of the coding unclear. The authors report that the confirmation aligned for at least one label for each of the inputs for 88% of the inputs. However, if I understand correctly, multiple groups of labels were applied (a priori vs. a posteriori; assessment cycle; topic).***

AR: *It seems that you understood our check for intercoder reliability correctly. Indeed, not all codes matched, but from at least one agreeing, we take confidence that the first author's coding was reasonable. However, this is a small test rather than a "calibration", because of the small sample size, limited agreement, and because all the coding was done by the first author.*

l.146

RC: ***at this point it is unclear to judge whether the sample of 17 inputs is representative of the entire sample as the authors don't provide information on the total amount of inputs that were coded. Just assuming every student provided one input for each reflection round, I would expect 5 times 2 times 17, so 170 inputs to be coded. This also links to the disclaimer by the authors that not all codes were considered for the analysis in the study. Do the authors intend to share the statements and their coding?***

We agree that the explanation and documentation of the coding needs to be more explicit. Therefore, we have added an example of the coding in Sec. 2.2.

> For example, the statement "Significance of values and society for goals and principles of climate science" was coded as "After: role of values in science", "values enter science" and "combine science with social science". We described the latter code as "to understand climate science, science and social science come together". This assignment includes some inference from the student's statement and highlights the interpretative nature of the coding. The resulting codes and their descriptions are listed in Appendix B.

We hope that this example also makes clear again that there is subjectivity in the coding. This also makes it difficult to judge what sample would be representative, but as explained above a calibration or similar was not our aim. We have also now shared our codes in tables in Appendix B. For data protection, we do not share the students' original statements. As we were going through all codes again, we have included some in the Figures that we had previously excluded. The ones that remain excluded are highlighted in the tables

in italics, and we have excluded them because they relate to features of the climate system that the course treated but that the reflections were not targeting.

l.156ff

RC: ***in line with one of my earlier comments, this section on participant bias could be better integrated. It is currently presented as an afterthought not really linked to the previous paragraph.***

AR: *Thank you for the suggestion! We have paired this paragraph with the one discussing caveats in the conclusions section, in a new Sec. 3.4.*

l.176

RC: ***The authors use 'theme' in different, but aligned contexts (see also figure 1), which is a bit confusing to the reader.***

AR: *We distinguish between 'theme' (two themes of the course: 1. numerical modeling and climate models, 2. critical reflection) and 'topic' (topics of the course or in the exercise) now.*

RC: ***I also wonder if it might be more helpful to add figure 1 in this section than in the introduction as a representation of the dense description of the course contents. In line with later comments it could also be good to introduce the figure and its components as part of the methods to offer clear elaboration on the different components of the course.***

AR: *In line with reviewer 2's comments we have revised the Figure substantially. We agree that this Figure also aids the Methods and Results section, but it is first mentioned in the Introduction and serves to show the four course topic groups there.*

l.236

RC: ***I just noticed here that somewhere between the introduction and the results, the authors start using the term science and technology studies (STS) content as a placeholder for certain aspects of the course. It might be helpful to clearly introduce or link these aspects to STS instead of keeping it implicit.***

AR: *Thank you for pointing us to the improper use of that placeholder. We have modified the naming of the "Interaction with society and critical reflection" part of the course throughout with either this direct naming or the link to both philosophy of climate modeling and STS.*

Figure 2

RC: ***This is an interesting representation. The colors don't seem to be color-blind friendly (I checked on grey-scale).***

We thank the reviewer for spotting this. As we struggled to find so many tones of red and blue that were color-blind friendly we opted for dividing the circle into slices and label each slice correspondingly, which we find improves the readability of the figure in general.

I have a couple of comments/questions:

Reflections on Human influences seem to be only linked to introduced values. One could argue that values are also a source of uncertainty. Likewise, values link to the fact that science is not objective (how science works). Similar patterns could be identified across different categories (e.g. linked to parametrization and choices; errors and uncertainty). What I am aiming at is the question of how the authors justify the labels they chose, how they defined each of the categories to ensure they are clearly distinct.

AR: *We have added a sentence to the caption to clarify that these categories are not exclusive and rather meant to represent themes than to clearly distinguish them. The caption of Fig. 2 now reads in full:*

> **Figure 2.** Overview of topics brought up in the reflective exercises, over all three assessment rounds and both a posteriori and a priori answers. The codes are color-coded by ~~themes~~ topics as in Fig. 1 (red tones for "Interaction with society and critical reflection", blue tones for "Modeling the climate system"), but deviate from the exact topics mentioned there, because students were only reflecting on parts of the course, and noted other points than we considered in the course structure that underlies Fig. 1. For example, the topic "How science works" was not an explicit part of the course structure and is thus marked grey. The topics were assigned inductively during the content coding and are meant as representations rather than mutually exclusive definitions. See Fig. 3 for codes that specifically treat the "a priori" and "a posteriori" content of the exercises. The circle areas correspond to the number of times the codes were assigned.

For a moment, I thought the authors have used the categories as mentioned in Figure 1, but this seems not the case strictly speaking (see e.g. complexity, model development etc.). I wonder if that could be helpful to make the boundaries clearer and offer a consistent set of aspects considered/discussed. It could for example also help show that some of the aspects of Figure 1 seem to be not represented in the reflections at all (e.g. greenhouse gas,. . .), which also shows where the focus of the course lies (or the focus of the things new to the students). If such an approach were used, it could still be important to introduce Figure 1 and the mentioned categories a bit more explicitly.

AR: *Indeed, only the four top-level categories from Fig. 1 were used, i.e. red tones in Fig. 2 correspond to "Interaction with society and critical reflection" in Fig. 1. While Fig. 1 gives the topics we would say the course treated and that were explicit subsections in the program, what the students noted in the exercises differed. That is because the reflective exercises came up only at certain points in the program (for example not directly after treating greenhouse gases), and because some topics raised more thoughts in the students than others. The difference between the topics in Fig. 1 and 2 is the reason for and the result of our inductive content analysis, it is the difference between what the course structure planned and what students took away from the course.*

Also, while the authors mention that they apply a red-blue color-coding, they also have grey and green(ish) colors, which seem (at least to me) to fall outside the promised color-scheme.

AR: *We have removed the teal color with a different shade of blue and have added to the caption to make the color scheme description and the point explained above clearer (see above).*

Why are the bubbles of the same color not next to each other? It makes it more difficult to discover the relative importance of different labels.

AR: *The problem of scattered bubbles of the same color is resolved in the revised version of the figures.*

Also, if some of the statements are coded with up to 4 labels, it could be helpful to consider alternative visualization types, like Sankey or Circles, which also show linkages between different reflections and labels. It could even help to distinguish different levels of detail of the reflections.

AR: *We thank the reviewer of their suggestion on improving the illustration of the reflective exercise. The bubble plot was chosen for its compactness and conciseness. While initially we were also interested in the evolution of ideas, each reflective exercise turned out to focus on the modules treated only before this exercise so the comparison between exercises is not so meaningful. Codes that were assigned in combination with the same quote are usually naturally linked and in the same direction. Also in the same exercise students usually expressed logically related ideas, thus showing their relationships would not reveal surprises.*

l.251-279

RC: ***I would like to suggest the authors reconsider the structure of the first part of section 3.3. The emphasis in the text does not seem to align well with the emphasis in the figure 2. For example, the authors start by talking about visions as one of the prominent themes (which seems not to be one of the most important themes according to Figure 2). Instead, I would expect to first get some high-level interpretation of the figure highlighting biases regarding the amount/intensity of reflections between STS or model technicalities or the respective themes, especially when also taking into account how much time was dedicated to these themes during the course. I would also be curious why the authors chose to share some reflections on the theme of visions and not Climate model development, which seems to have received the most reflections according to Figure 2. I like the emphasis of a topic (how science works) which was not intended to arise during the course but seemed to keep the students busy anyways. In line with the discussion of the theme where students had most similar reflections (scenario manipulation), it could also be interesting to reflect on the theme where the reflections are most diverse.***

AR: *Thank you for this suggestion. We have added a high-level interpretation on the frequencies and reflections on the topic of climate model development. However, we would also like to note that this qualitative exercise is not meant to be interpreted quantitatively. As you note elsewhere, the topics we have coded are interpretations rather than definitions. For example, whether one groups "uncertainty" as its own topic or as a subtopic of "complexity and model problems", changes frequencies drastically. Thus the idea behind the qualitative methodology and the identified topics is to make visible what students were thinking about but not to rank topics according to importance. Therefore, the text is more informed by topics we found interesting to discuss and elaborate on, in particular in relation to our research questions and the aspects that are unique in our course.*

The frequencies of topic mentions also relate to when the reflective exercises were conducted (see Fig. 1 b): for example, the topic group "1. Dynamical systems" was not explicitly sampled, because the emphasis of our evaluation was on topic block 3 and 4. Regarding climate model develpoment – one of the most prominent topics mentioned – students highlighted topcis that were explicitly treated in the course, such as the model structure or parameterisations (Stensrud, 2007). A particular piece of research that has left an impression on some of the students is climate model geneaology (Knutti et al., 2013; Kuma et al., 2023), meaning how different (generations of) climate models are interconnected, for example by one model being built on the basis of another. In particular, Kuma et al., 2023 have provided a display of models' relationships in their Fig. 2, which we have used to visualise both the multitude of models, the countries of those who develop them and the interrelationships. This visualisation speaks to the students as they have repeatedly refered to it during discussions in the course.

Because of the limited answers, we also find it difficult to state where reflections were most diverse. Our interpretation is that students simply had different topics that stood out to them. While they had no major disagreements (for example one saying that climate models are complex and another that they are simple), often only few students commented on a particular topic.

Figure 3

RC: ***I again find this an interesting visualization. Similar comments as to Figure 2 apply regarding the design (color-palette).***

AR: *We've introduced the same changes for Figure 3 as for Figure 2.*

Some more comments:

Some of these labels seem quite frank and plain (e.g. disappointed in physics' unimportance", "Some things are simple"). I was wondering if the authors have some reflections on these label-choices, their representativeness and value for the study, especially in the light of earlier discussed lack of obvious misconceptions.

AR: *In the choice of the labels, we tried to stay as close to the student statements' content as possible while keeping the labels short for the visualisation. This possibly explains why they may be perceived as frank but in our opinion it makes them more representative. For example, the statement that we coded as "disappointed in physics' unimportance" was "Bedeutung der Physik → ich hatte das als viel relevanter eingestuft als es bis jetzt rüberkommt" in RE1. We do not view this as a misconception because the student may not perceive differential equations as "physics", and because indeed a climate model is not simply a reflection of physics but contains knowledge from other scientific disciplines as well as technical components, empirically-derived findings, approximations, developers' choices and judgements.*

Spelling and formulation suggestions

RC:

- ***Fig. 3: Spelling in caption: "The circles for "a[ ]priori""***

- ***l.25: allow to enter [the design and analysis process]?***
- ***l.27: GCM instead of GMC***
- ***l.64: "… take part in the NAka program [each year]"***

AR: *Thank you for the suggestions and spotting the error. We have implemented them as you suggested.*

2. Reviewer #2

RC: ***Thank you for inviting me to review this manuscript. The research presents an interesting example of a BSc level interdisciplinary course covering both the technical, conceptual and social aspects of climate modelling. The course has been taught multiple times already and was continuously improved by the authors through each iteration. In addition to the relevant course content, the authors also provide the results of an analysis of two key reflection exercises included in the third iteration of the course. The manuscript is well written and to the point. From my perspective, it should go through a round of minor revisions before being ready for publication. In particular, I would recommend the following minor improvements, which mostly aim at including clarity, particularly on the overall structure of the course and its phases:***

AR: *Thank you for your detailed comments that have helped us to improve the manuscript and clarify our descriptions.*

2.1. Specific comments

Course level

RC: ***I would recommend already mentioning how the course was taught to high school students (although it is at a BSc level) earlier in the manuscript, ideally in the introduction section already. From my perspective this further highlights how the course achieves to be both entry-level (no BSc level knowledge, or even coding, expected) and to reach the learning objectives you present.***

AR: *The high school level was mentioned in the introduction, but we have added a sentence taking up your suggestion to highlight the relevance further:*

> While these topics may seem advanced, the course is ~~geared towards advanced high school students and~~ entry-level and requires no BSc level knowledge or coding experience.

L47

RC: ***Here you also refer here to a 'generally small base of literature that explicitly treats the teaching of climate modelling': could you refer to some of this literature? There may be relevant previous publications from this Journal that could be useful for this.***

AR: *Sure, we have added references to some of this literature in the main text. Note that while these treat the understanding of climate modeling from a natural science perspective, none of them combines it with the topics we teach in the "Interaction with society and critical reflection" topic group.*

> To our knowledge a course like this has not been documented in the literature before, and thus this study contributes to a generally small base of literature that explicitly treats the teaching of climate modeling (see e.g. Storch et al., 1999; McGuffie and Henderson-Sellers, 2005; Stensrud, 2007; Stocker, 2011; Slawig, 2015; Gettelman a
> .~

RC: ***To strengthen the connection between the course topics in Figure 1 and the bullet points in page 2, I would suggest you change the bullet points to a numbered list, and use the same numbers for each line in the figure. The connection with the following figures is already clear thanks to the colours used.***

AR: *We have added the numbering to both places (see also answer to Reviewer 1).*

L122

RC: ***What are the modules which you foresee would trigger thought processes in the students? I would recommend to strengthen the connection between this section and the course structure to avoid confusion.***

AR: *We have made the modules and connection explicit:*

> ("Climate model structure" and uncertainties; "philosophical problems", trust and co-production; "culture of prediction"; values and visions; see Table A1)

This paragraph is not also somewhat confusing as it remains ambiguous on which rounds of improvements did the course go through, when you implemented which improvements and why, and which course iteration are your results based on (I believe the results are 'just' from the 3rd iteration. But you mention this somewhat inconsistently throughout the text.

AR: *We believe the fact that our formal evaluation is based only on the third iteration (in 2024) has become more clear in addressing the comments from Reviewer 1. We have also made it clear in the sentences you reference here by adding the years:*

> In the second cycle (2023) we attempted to get an impression of students' reflective change by asking in a survey in the end how their perceptions changed, but their answers were shallow and short. Thus, for the formal evaluation in the third cycle (2024) we opted against an assessment at the end of the course.

L142

RC: ***Please mention what software (Nvivo, Atlas.ti…) you used for the qualitative coding. If no software was used, please also clarify by mentioning you coded the text manually.***

AR: *Thank you for noticing that oversight:*

> After the course completion, we applied inductive, open-coded content analysis (Cohen et al., 2011) to the students' output, using QualCoder (Curtain and Dröge, 2025).

L156

RC: ***The last paragraph of the methods section (starting at L156) would better belong to the discussion section.***

AR: *We have pulled this paragraph together with a paragraph on caveats in the conclusion section, into a new Sec. 3.4.*

RC: ***Your results section would much benefit from the inclusion of a simple figure visualizing the course structure. This may be the figure you currently have in the annexes, or you could have in the main text a more simplified version of that image and leave the full one in the annexes. This would allow the reader to better grasp the different course components (and which course components where used for data collection and the results are based on) and your results would also become clearer. You may then also clarify when the reflective exercises took place throughout the course.***

AR: *Thank you for this suggestion! We have simplified the tables from the annex and combined it with information from Fig. 1 to create a combined Fig. 1 with panel a and b. In this way, the course components and which of them influenced the exercises are more clear now.*

RC: ***Please differentiate the two reflective exercises by calling them 1 and 2 or providing them a name to make sure their distinction is clear throughout the results and discussion sections. Clearly naming them in the new figure suggested above would also help with this. Similarly, it would be helpful if you could more clearly introduce when multiple discussion rounds were included in the reflective exercises (may also be included in the visualization if you deem fit).***

AR: *Indeed we have included the reflective exercises in the new Fig. 1b, which helps to see which modules were included in each round. We hope that this (together with the caption) also makes more clear that there were three rounds of the reflective exercise – and each contained the "a posteriori" and the "a priori" question. Note that we also noticed a mistake in our previous manuscript: while we had initially planned five rounds of the reflective exercise, we only implemented four, and the last one was not used for the analysis for this study because the topic of that exercise had yet a different scope.*

L271

RC: ***'Informal conversations with students…' Can you provide more context here with your suggested explanation, and where possible referencing? Would also be interesting to know more about the impact of the changes implemented mentioned in L 278: Did your efforts help solving the issue? What do you/did the student deem 'a right balance' and why?***

AR: *We have expanded our explanations with detail and references as follows:*

Informal conversations with students at the NAka 2025 pointed us to what these pre-conceived ideas could be about: students were sensitive to fake news and manipulative statements, seemingly because of frequent treatment of these issues in school (see e.g. ISB-Arbeitskreis Link-Ebene, 2004; Democratic Schools for All, 2026), also due to the growth of right-wing populism in Germany (Franke et al., 2024). While scenarios do have a large influence that should be questioned, manipulation is not what climate science uses them for. Here we recognize an issue that ~~science and technology studies~~ STS have had to grapple with: on the one hand, from a constructivist point of view one comes to criticise the power of science and its human foundations (see~~for example Jasanoff (1996), and Moon and Blackman (2014)~~ , for example, Jasanoff, 1996, and Moon and Blackman, 2014 for an explanation of constructivism). On the other hand, most critics do recognise science's results as true and do not wish to imply that for example climate change is not real. This is a delicate balance to be struck ~~(see for example Schindler (2020)~~)(see, for example, Schindler, 2020). From the students' responses we saw that ~~our balance was off and consequently~~ they conflated subjectivity within the scientific process with more or less deliberate manipulation. Consequently took more time in the next year to introduce scenarios more rigorously, detailing their scientific basis as well as the choices embedded in their creation and the need for careful interpretation of the scenario used in a study.

2.2. Technical comments

RC: ***I would recommend you start the conclusion section by reiterating what your research questions were and how you attempted to answer them through your paper, so to recontextualise your findings.***

AR: *Great suggestion! We have added to the beginning of the conclusions section:*

We have presented the making and evaluation of an interdisciplinary course on climate modeling that combines physical knowledge about the climate system and how to construct numerical models with perspectives and reflections from philosophy of climate science and STS. In this study we wanted to understand what the students' learning looks like, whether the course triggers thought processes and in particular changes students' thinking about climate models.

L214

RC: ***will you include the index cards used and some of the constructed timelines (if available) in the annexes?***

AR: *These are included in the material we uploaded at zenodo (Proske and Staab, 2026), and we have now included that hint in the main text where you suggested*

For example, by constructing a timeline from given index cards, the students dissect the co-evolution of climate models alongside relevant historical events (for the material, see Proske and Staab, 2026).

as well as in the introduction:

First, document the course to give inspiration and materials for others (see course schedule in Appendix A and also the teaching material shared at Proske and Staab, 2026) .

L228

RC: ***What is a 'fish bowl discussion'? Please explain, as knowing more about the teaching techniques is definitively interesting for the audience reading his Journal.***

AR: *We have expanded the explanation:*

The course content ends with a "fish bowl discussion" of climate scientists' position in the climate change debates. ~~The students are again~~ In a "fish bowl discussion", students are divided in groups and get some input for a particular position they are asked to represent~~, ranging~~ . One student of each group then sits on the podium and represents this position in the discussion, but at any time another member of the group can leave the audience, tap on the discussant's shoulder and take up their position on the podium, allowing everyone to participate and bring fresh arguments to the table. In our case, the positions ranged from disinterestedness in public discussion to activist positions.

RC: ***Please state clearly whether the course content included in the annexes is that used through the 3rd iteration of the course. This can be mentioned throughout the manuscript and should be iterated in section 3.2.***

AR: *We thank the referee for this clarifying suggestion. We have added a reference to the schedule in Appendix A in the introduction and section 3.2. We further clarified that the course schedule is reflecting the third iteration (2024) of the course.*

L35

RC: ***can you provide some referencing here on said scientific debate and/or discussion papers on modelling practices?***

AR: *We have added references as you suggested:*

~~While the~~ The issues sketched above were studied and brought up by researchers from history and philosophy of climate modeling, or science and technology studies (STS, Jasanoff, 2007; Sismondo, 2010), but they have become part of the ~~scientific debate and~~ (climate) modeling debate (Rödder et al., 2020; Pulkkinen et al., 2022; Remmers et al., 2025) . While they have motivated the reflection on good modeling practices (Saltelli et al., 2020; Jakeman et al., 2024), they have yet to reach many modelers and model developers themselves.

Spelling and formulation suggestions

RC:

- ***L27 typo: you write GMCs instead of GCMs***

AR: *Thank you for spotting this error, which we have corrected.*

3. Editor

RC: ***Having carefully read both the revised manuscript and your response letter, I am pleased to note that you have addressed the majority of the reviewers' concerns thoughtfully and constructively. The restructuring of the Methods section, the addition of the combined Figure 1 with panels a and b, the new Section 3.4 on caveats and limitations, and the clarification of the course iterations and evaluation scope are all welcome improvements.***

AR: *Thank you for your appreciation as well as your comments on the manuscript and our response.*

However, before I can recommend acceptance, I would ask you to attend to a small number of remaining points:

1.

Figure 2 and 3 revisions: Please ensure the updated color scheme and bubble groupings are clearly legible in both color and greyscale versions of the manuscript, as the reviewers' concerns here were central to their feedback.

AR: *Thank you for highlighting this issue. We have additionally added the topics in the circumference of the new bubble plots to render the use of color unnecessary. Even without colour, the plots are legible now because of the grey bars separating the subtopics and because the topics are indicated clearly and named on the outside. We prefer this approach to trying to find 5 shades of red and three shades of blue that are separable in greyscale.*

2.

Coding documentation (Appendix B): Given the discussion around intercoder reliability and the interpretative nature of the coding, please confirm that the appendix tables are complete and that the rationale for excluded codes (marked in italics) is sufficiently explained for readers unfamiliar with qualitative methods.

AR: *In addition to what we already detailed in response to the reviewers, we have added a sentence to explain the rationale for excluded codes specifically.*

> The Appendix also lists the few codes that we excluded from the analysis because they relate to features of the climate system that the course treated but that the reflections were not targeting.

3.

Minor typographical and formatting consistency: A small number of formatting inconsistencies remain in the tracked-changes version of the response letter (e.g., citation formatting at l.25 and the GCM/GMC correction). Please conduct a final proofread of the revised manuscript to ensure all such corrections have been carried through consistently.

AR: *We are unsure what you are referring to here as we had not submitted a tracked-changes version yet (as the GC review process required the editor review first) and stated in the response that we would correct the errors. Accordingly, the citation formatting and GCM abbreviation are corrected in the new manuscript version that we are submitting now.*

4.

Clarity on the number of reflective exercise rounds: Your response clarifies that four rounds were implemented but only three were used for analysis. Please ensure this is stated unambiguously in the main text, as it differs from what was implied in the original submission.

AR: *We have clarified this in the manuscript as follows:*

> *We repeated this exercise ~~5~~ 4 times, giving each of the questions 5 minutes of time (see ~~Table A1~~Fig. 1 and Table A1, where the latter indicates that the fourth time was excluded from the analysis for this study, which is why we refer to only three exercise rounds in Fig. 1 and the remainder of this manuscript).*

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