DEBATES IN THE OCEANOGRAPHY CLASSROOM

CHALLENGING MISCONCEPTIONS AND ENGAGING WITH NEW KNOWLEDGE

By Lea Svendsen

Which component of the climate system is more important for determining climate, the atmosphere or the ocean? I pose this question to my students about halfway into the semester of a physical climate system course, and the discussion that follows is both fun and educational.

A few years ago, I was working on ways to increase active learning in my course. I had already incorporated low-threshold activities such as think-pair-share (Lyman, 1981, cited in Tanner, 2013) and one-minute papers (Stead, 2005). But I also wanted to add larger activities to conclude the main modules and motivate the students to reflect on how the main topics connect to the course as a whole. Furthermore, because students learn in different ways, I wanted to include a variety of strategies in my teaching. I had heard about the use of debates for deeper learning, that they can help students master content and develop critical thinking skills (e.g., Kennedy, 2007). However, I hadn't yet come across any examples of in-class debates in my fields of climate dynamics and ocean and atmospheric sciences. Here, I present a collaborative approach for concluding a module or topic in class inspired by debate exercises used in other fields.

In the physical climate system course I teach, the students should be learning about what determines Earth's climate, the interactions between the different components of the climate system, and the physics of climate change. Roughly 15 students usually take the course. Most are in their third year of undergraduate education and have been through introductory courses in fluid dynamics, oceanography, and meteorology. Attendance is not mandatory, but most students do come to class. While the local students have studied both meteorology and oceanography, approximately half the class is composed of exchange students with various backgrounds, with some having focused solely on oceanography or marine sciences in their studies.

THE DEBATE

I organize the debate activity after two to three weeks of in-class and out-of-class activities that cover the circulation of the atmosphere and the ocean. I use this activity to get the students to recall their new knowledge and reflect on this knowledge by comparing, justifying a stand on, and evaluating the relative importance of the different aspects of the atmosphere and the ocean in the climate system.

I begin the debate activity by posing the question: Which component is more important for determining climate, the atmosphere or the ocean? I then bring up two statements:

(A) The **A**tmosphere is more important for determining climate than the ocean.

(O) The **O**cean is more important for determining climate than the atmosphere.

The class activity proceeds according to the following five steps:

1. **Individual reflection**: Each student receives a note with either the letter A or the letter O upon entering the classroom. They then each reflect alone on the relative statement.
2. **Pair work**: Students pair up with someone who has the same letter, and the two of them make a list of arguments supporting their statement.
3. **Group discussion**: Groups of four students with the same letter share their arguments and evaluate whether they are theoretically sound.
4. **Debate**: New groups are formed with equal numbers of A's and O's per group to debate the question posed above, with students arguing for the statement assigned to their letter. To get them to debate instead of just listing facts about the ocean or the atmosphere, I encourage them to listen to each other's arguments and connect the arguments from each side. An illustrative example I often use is: "Who would win a fight of tigers against lions?" One might say the tigers would win because they are bigger than lions; however, lions hunt in groups while tigers hunt alone, so the combined mass of lions in a fight would be greater than that of a single tiger.
5. **Debrief**: Students share thoughts, and we conclude in a plenary session.

I spend about 35–45 minutes in total on this activity, including the introduction to the activity and the time it takes to switch groups. I give the students a couple of minutes on the first step

where they reflect alone; the following steps take about 5–10 minutes each depending on the class dynamics and the students. For planning, I also consider a couple of extra minutes for the time it takes to form groups between the steps.

Since the first time I included the debate in my classroom, I have experimented with different ways of implementing this activity and added more steps. One essential change I made after the initial test of the activity was adding steps 1 and 2 where students first reflect individually and then share their ideas in pairs before forming larger groups (think-pair-share). These steps ensure that all voices are heard, students feel ownership of the arguments, and more students are comfortable contributing to the debate. In addition, students are more active during the debate when they have worked in different groups and pairs previously in the course, as this makes it easier for them to share their views (Lewis et al., 2016; Ballen et al., 2019).

CONCLUSION AND STUDENT FEEDBACK

I introduced the debate activity to elevate in-class learning beyond simply remembering the facts about the ocean and the atmosphere. My aim was also to encourage the students to reflect on what the climate system is and what determines climate on Earth, thereby connecting the module on atmosphere and ocean circulation to the overarching learning goals of the course. Feedback from the students indicates that this activity is working the way I intended. One student noted, "I thought [this activity] was critical in order to combat previous misconceptions." Another student said, "[This activity] motivated me to consider my own biases, both from previous education and what I think I understand, and it challenged whether they are really true and how they connect to my new understanding of the climate." The students also think that the debate is an effective way to summarize a topic. For example, one student expressed that it helped him "to understand the importance of both atmosphere and ocean and know more about why they both are important."

Furthermore, the students seem to enjoy the debate, which can support deeper learning (Stanton et al., 2016). I often see them laughing and actively engaging in the groups. As one student noted: "I think it was interesting to debate with other people, where I can hear other perspectives on what they think about different topics." But students engage in different ways; some students are enthusiastic about the debate format and argue passionately for their assigned roles as if in a political debate, while others use the exercise to engage in scientific discussion. Even the quietest students participate, though their engagement is more subtle. This is likely supported by the small class size and their familiarity with many of their peers from working in different groups throughout the course.

In the end, the students usually agree that neither the ocean nor the atmosphere is more important for determining climate, and the answer could depend on which aspects of the climate they focus on. For an in-class debate like the one described here, I recommend choosing topics where there is no clear right answer and where neither side carries greater value or moral weight.

REFERENCES

Ballen, C.J., S.M. Aguillon, A. Awwad, A.E. Bjune, D. Challou, A.G. Drake, M. Driessen, A. Ellozy, V.E. Ferry. E.E. Goldberg, and others. 2019. Smaller classes promote equitable student participation in STEM. *BioScience* 69(8):669–680, https://doi.org/10.1093/biosci/biz069.

Kennedy, R. 2007. In-class debates: Fertile ground for active learning and the cultivation of critical thinking and oral communication skills. *International Journal of Teaching & Learning in Higher Education* 19(2):183–190.

Lewis, K.L., J.G. Stout, S.J. Pollock, N.D. Finkelstein, and T.A. Ito. 2016. Fitting in or opting out: A review of key social-psychological factors influencing a sense of belonging for women in physics. *Physical Review Physics Education Research* 12(2), https://doi.org/10.1103/PhysRevPhysEducRes.12.020110.

Lyman, F. 1981. The responsive classroom discussion: The inclusion of all students. Pp. 109–113 in *Mainstreaming Digest.* A. Anderson, ed., University of Maryland College of Education, College Park, MD.

Stanton, A., D. Zandvliet, R. Dhaliwal, and T. Black. 2016. Understanding students' experiences of well-being in learning environments. *Higher Education Studies* 6(3), https://doi.org/10.5539/hes.v6n3p90.

Stead, D.R. 2005. A review of the one-minute paper. *Active Learning in Higher Education* 6(2):118–131, https://doi.org/10.1177/1469787405054235.

Tanner, K.D. 2013. Structure matters: Twenty-one teaching strategies to promote student engagement and cultivate classroom equity. *CBE-Life Sciences Education* 12(3):322–331, https://doi.org/10.1187/cbe.13-06-0115.

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ARTICLE CITATION

Svendsen, L. 2026. Debates in the oceanography classroom: Challenging misconceptions and engaging with new knowledge. *Oceanography* 39(1), https://doi.org/10.5670/oceanog.2026.e103.

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