

CLIMATE CHANGE, OCEAN ACIDIFICATION, AND VIRTUAL REALITY GUIDE FOR TEACHERS

Prepared for teacher implementation at the 8th-grade level

Project focus	Global climate change, greenhouse gases, ocean acidification, and biodiversity
Core approach	Scientific inquiry-supported implementation + conventional lesson flow + IVR/video support
Resources used	Teacher plans, student activity sheet, and the virtual reality experience recording

This guide was designed to help teachers plan the classroom process, use video/VR content for pedagogical purposes, and integrate the student activity sheet effectively.

1. Purpose of the guide

This guide provides teachers with an integrated implementation framework for teaching climate change and ocean acidification at the 8th-grade level. It brings together two instructional pathways: a presentation- and discussion-oriented conventional lesson plan and a scientific inquiry-based flow built around generating research questions, collecting data, forming hypotheses, and interpreting results.

At the center of the guide is students' observation of changes in the ocean ecosystem through the virtual reality experience or video recording, and their transformation of these observations into the activity sheet. In this way, the topic moves beyond being merely explained and becomes a learning experience that is observed, discussed, and interpreted.

2. Core components of the instructional approach

- Conceptual basis: global warming, climate change, greenhouse gases, ocean acidification, biodiversity, and the chemical structure of aquatic environments.
- Inquiry dimension: active student participation in observing, generating questions, making predictions, forming hypotheses, preparing data tables, and developing inferences.
- Visualization dimension: enabling students to track change over time concretely through the IVR environment or the video recording.
- Interpretation dimension: transforming collected data into graphs, reports, future predictions, and proposed solutions.

3. Intended gains and learning outcomes

- Students interpret the effects of global climate change on biodiversity and aquatic environments through concrete cases.
- Students relate increasing greenhouse gases to changes in ocean temperature, pH levels, and species diversity.
- Students participate in the process of forming and testing hypotheses through observation- and data-based explanations.
- Students express scientific findings through graphs, tables, short reports, and oral presentations.

4. Teacher preparation before implementation

Preparation area	What needs to be done
Concept preparation	Review the basic concepts of climate change, greenhouse gases, ocean acidification, and marine biodiversity.
Material check	Test the video link / VR recording, projection, sound system, and, if available, the VR headset.
Activity sheet preparation	Print the student activity sheet or prepare it digitally for classroom use.
Grouping plan	Decide whether the implementation will proceed

Discussion questions

individually, in pairs, or in small groups.

Prepare short prompts in advance for the pre-viewing, viewing, and post-viewing stages.

5. Suggested three-week implementation flow

Week/Lesson	Focus	Teacher role	Output
Week 1 Introduction and conceptual grounding	Climate change, greenhouse gases, ocean acidification, biodiversity	Activates prior knowledge, clarifies concepts, and establishes real-life relevance.	Concept map, class discussion, prediction statements
Week 1–2 Video/VR-supported observation	Observation of change in the ocean ecosystem over time	Guides attention to key variables and asks students to take evidence-based notes.	Observation notes, initial findings, questions
Week 2 Activity sheet analysis	Recording measured/observed values, building relationships, and forming hypotheses	Supports students while filling in the analysis pages and turning observations into data.	Hypotheses, data table, graph draft
Week 3 Conclusion and interpretation	Interpreting evidence, discussing future predictions and proposed solutions	Leads classroom discussion, compares group responses, and deepens scientific reasoning.	Short report, group presentation, solution proposals
Alternative implementation	Use of the conventional teacher guide or the inquiry-based guide	Selects the lesson flow according to class profile and available time.	Lesson plan adapted to the class level
Assessment closure	Evaluation of process and products	Uses the activity sheet, participation, and outputs for process-based assessment.	Teacher notes, student products, feedback
3/2	Yorum ve çözüm	Gelecek tahminleri, çözüm önerileri ve mini sunumlarla süreci tamamlar.	Rapor, öneri ve sunum

6. Use of the video and virtual reality material

The YouTube link shared in the project is a recording of the interactive virtual reality environment. Teachers can use this recording for two purposes: (1) as a visual observation tool for students who cannot access the IVR experience, and (2) as a shared reference that initiates in-class analysis and discussion after the IVR experience.

Indicators students should pay particular attention to while watching the video:

- **Change in pH values over time**
- **Increase in temperature and its reflection on species diversity**
- **Relationship between CO₂/greenhouse gas increase and chemical change**
- **Comparison of past, present, and future scenarios**
- **Links between observed changes, daily life, and human impact**



QR code for the video link

7. Teacher question bank after the video/VR

- Which variables did you observe directly? Which ones did you infer indirectly?
- Which of the changes you observed may be triggering the others?
- As time progressed, what relationship did you notice among pH, temperature, and species diversity?
- Is it possible to generate different hypotheses from the same observations? Why?
- Would you explain these changes only through natural processes, or also through human impact?
- What is your strongest piece of evidence regarding the future?

8. Integration of the activity sheet into the lesson

The student activity sheet makes the research–analysis–conclusion–interpretation cycle visible. The sample pages below help the teacher plan which page to introduce at each stage.



3. My hypotheses based on my observations;

If this value.....(↑ or ↓); that value(↑ or ↓)
 If this value.....(. or); that value(or)
 If this value.....(. or); that value(or)
 If this value.....(. or); that value(or)

3. Can the hypotheses you stated above be tested?

My Hypothesis	My Data

Analysis page: moving from observation to hypothesis



1. Put the values you measured in the table. (What did you observe?)

		Time		
Values				

2. Draw a graph about the data you measured  (What does the data tell us?)



Analysis page: building the data table and graph



Predictions for the future

How will marine life be affected in the future? How will humans be impacted by this situation?

Proposed solutions

What actions can be taken to mitigate the effects of greenhouse gases?

Interpretation page: future predictions and proposed solutions

9. Practical implementation suggestions for teachers during the lesson

9.1 At the lesson introduction

- Use examples from students' own surroundings; build connections through weather events, water resources, and environmental change.
- Briefly distinguish between global warming and climate change so students do not confuse the two concepts.
- Create a shared concept pool on the board to make students' prior knowledge visible.

9.2 During video/VR observation

- Ask students not only to watch, but also to record observations that can function as data.
- During observation, use the question 'Why might it have changed?' as much as 'What changed?'
- Instead of providing too much information at once, ask students to focus on 2–3 key indicators.

9.3 During the analysis stage

- Make sure hypotheses are testable and clarify vague generalizations.
- Emphasize that graphs and tables are not just drawings, but tools for interpretation.
- If different interpretations emerge across groups, treat them as an opportunity for discussion rather than as errors.

9.4 In conclusion and interpretation

- Help students distinguish between measurement, evidence, and inference.
- Encourage students to think about proposed solutions at individual, societal, and global levels.
- At the end of the topic, ask students to write one 'strongest evidence sentence.'

10. Assessment suggestions

Assessment dimension	Indicators to observe	Source of evidence
Conceptual understanding	Ability to explain the relationship among climate change, greenhouse gases, ocean acidification, and biodiversity	Student statements, activity sheet responses, short written report
Observation and data use	Ability to identify variables, record data, and use observations as evidence	Analysis page, table, graph
Interpretation and inference	Ability to make future predictions and infer cause–effect relationships	Interpretation page, class discussion
Participation and collaboration	Engagement in group work, discussion, and presentation process	Teacher observation notes, peer/group products

11. Brief teacher checklist

- ☐ I opened and checked the video/VR material before the lesson.

- ☐ The activity sheet printouts and group arrangement are ready.
- ☐ I identified the key variables that students will observe in advance.
- ☐ I planned my discussion questions for the introduction, analysis, and conclusion stages.
- ☐ I reserved time at the end of the lesson for a report, graph, or short presentation.

12. Final note

This guide was prepared to help teachers build the lesson around observation, inquiry, data analysis, and interpretation rather than one-way information delivery. The greatest strength of the material is that it enables students to transform the changes they see in virtual reality or video into a process of scientific thinking. The teacher’s main goal is to turn what the student “sees” into a learning experience that they “explain, justify, and interpret.”