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Climate Change and Its Impact on Biodiversity



BIOS4YOU
AR 2.0

BIO-INSPIRED STEM TOPICS FOR ENGAGING YOUNG GENERATIONS
THANKS TO THE USE OF AUGMENTED REALITY

Project Number: 2023-1-DE03-KA220-SCH-000126516

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General information

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Name of the
exercise:

"Ecosystems on the Edge" AR

Description of the
exercises:

This project uses Augmented Reality to explore the effects of climate change on biodiversity across different time periods making learning interactive and engaging. The activity promotes critical thinking and awareness of the UN 2030 Agenda goals or the sustainability actions that people should do to prevent the extinction of the species and the scientific studies.

Through their mobile devices or tablets, students interact and experience immersive scenarios — from medieval manors to coral reefs, the Seychelles, and the Arctic — with contextual videos and challenges in each phase. Students must choose between multiple options, each questions with different points and outcomes.

Participants:

The activity is designed to be done **individually or in small group of 2-3 students**, with optional group reflection afterward (ongoing feedback). Individual participation ensures that each student makes their own decisions throughout the experience, fostering personal responsibility in awareness of critical or sustainable thinking.

Group discussions, at the beginning and at the end of the activity, allow comparison of the basics and of the results and reasoning behind choices, strengthening collaborative learning and peer feedback.

Participants' age
range:

Minimum age: 15, Maximum age: 17

The exercise assumes prior basic knowledge of environmental science, climate change, biodiversity, agenda 2030, thermodynamics, basic physics and chemistry concepts, at last familiarity with smartphone/tablet use. Students at this age are cognitively ready to engage in abstract and critical thinking, ethical reasoning, application and deductions of scientific rules and real-world problem-solving.

STEM subject and
specific topic:

The exercise addresses the challenge of making “the impacts of climate change and biodiversity loss” comprehensible. Students often struggle to grasp the complexity and scale of these phenomena across time and space. Augmented Reality (AR) helps simplify and clarify this by visually presenting each stage in a clear, interactive way.





Gamification process:

Students navigate through different scenarios - from a school in the present to past, present, near-future and distant-future scenarios around the world - they face questions and choices that help them realize and face the truth of the impacts of pollution and climate change on ecosystems and the risks for biodiversity. Each decision either earn you “points” or none at all, creating a dynamic scoring system that reflects their awareness and understanding.

Written or graphic description of Augmented info:

- Animated characters who guides students: teacher, diver man, tourist guide, marine biologist.
- Information overlay: Decision prompts and visual feedback effects (images, references, dialogues, actions).
- Floating 3D choices: Students select video options by tapping icons, objects, animals or just by scrolling the indicator.
- Static AR environments: Each scenario is shown as a themed diorama (coral reef, Seychelles...).
- Bonus interactive hotspots: Hidden videos and facts revealed through interaction.

The AR experience is anchored via image recognition or QR markers, and requires no physical movement — it's designed to be used at a desk or classroom table — but with MR headset the physical movement could be implemented.

External (or extra) tools required

Mobile device or tablet with AR capabilities. Internet connection for initial file loading. Printed AR marker sheet (optional) or screen-displayed trigger image, Mixed Reality headset (MR headset or AR headset).

Links (video, images, text online and so on).

Suggested videos for advanced level:

<https://www.youtube.com/watch?v=glkHV28lnXA>

[Study: Baby turtles at increased risk of dying from ingested plastic - YouTube](#)





Pedagogical specifications

How can this augmented information be used to address a STEAM topic in a more interesting way for students?

The session uses Augmented Reality (AR) to make a STEM topic, often considered stressful, engaging and accessible. AR combines visual, auditory, and interactive elements to simplify complex concepts and stimulate curiosity. Students navigate through different scenarios — past, present, near future, and distant future — each enriched with **augmented information** such as **3D models** (castles, coral reefs, islands, polar regions), contextual pictures and videos (e.g., coral bleaching, rising sea levels), and immersive landscapes with an easy going narration. At each stage, like different increasing levels, learners face **interactive quizzes** about the videos or the lesson. Correct answers add points to a dynamic scoring system, encouraging active participation and **reinforcing knowledge** without excessive pressure. The goals are to **reduce stress with the gamification implementation**, **increase motivation**, and promote **critical thinking** on climate change and biodiversity. The narrative structure also fosters awareness of sustainability, linking directly to the **UN 2030 Agenda goals**. This approach turns abstract scientific challenges into a **playful, immersive experience**, where students explore, reflect, and learn through interaction.

Which pedagogical objectives are addressed through this scenario?

The AR exercise allows students to better understand complex STEM concepts by turning abstract ideas into concrete, visual experiences, **enhancing comprehension**. Immersive scenarios help learners **explore the impacts of climate change and biodiversity loss** in a way that is both scientific and emotional, encouraging **critical thinking** about **cause–effect relationships across time and space**. At the same time, the use of video, images, and 3D models creates emotional engagement, making the learning process memorable and impactful. The dynamic scoring system fosters **active participation and motivation**, while **promoting curiosity** and **reflection** in the students. By connecting classroom content with real-world challenges and the UN 2030 Agenda goals, students not only acquire knowledge but also develop a stronger **awareness that can influence the choices of everyday life**, also making good actions for the planet. The **collaborative dimension** of the activity, where learners share and compare choices, make little projects, further strengthens **communication and teamwork skills**, making education both successful and emotionally engaging.





Which results are expected to be reached with its use?

This AR exercise aims to achieve learning outcomes that are often difficult to reach through traditional teaching methods. While conventional lessons may provide theoretical knowledge, they often fail to create the sense of **immersion, motivation, and emotional engagement** necessary for long-term retention and understanding. Through interactive scenarios, students do not only acquire **specific knowledge** about biodiversity, climate change, and their global impacts, but also develop a **suitable mind set for STEM learning**. By actively exploring past, present, and future environments, learners understand cause-effect dynamics in a more tangible way than reading a textbook could provide. The combination of visual 3D models, landscapes, and interactive choices makes abstract concepts concrete and memorable. At the same time, the dynamic scoring system transforms learning into a **game-like experience**, lowering anxiety and fostering curiosity. As a result, students gain not only factual understanding but also a proactive and reflective attitude toward STEM topics, sustainability, and problem-solving. In this way, the **AR exercise bridges the gap between knowledge acquisition and mind set development**, something rarely achieved in a traditional classroom setting.

Which benefits are expected to be reached with its use?

The use of AR provides students with a dual benefit. On the **disciplinary level**, it **enhances the understanding of complex STEM concepts** such as climate change, ecosystems, and biodiversity through immersive, visual, and interactive content. **Knowledge** that is often abstract becomes concrete, tangible, and easier to connect with **real-world sustainability challenges**. On the **practical and sensory level**, AR engages multiple senses—sight, hearing, and interaction—**stimulating curiosity** and strengthening retention. At the **recreational-social level**, the game-like scoring system and collaborative discussions transform learning into a playful, **shared experience**. This mix of science, creativity, and **teamwork** not only improves knowledge acquisition but also fosters **motivation, empathy**, and a positive mind set toward STEM education.





Technical specifications

AR INFORMATION

Technology

[Delightex – Interactive 3D Worlds for Everyone](#)

<https://asblr.com/JksbuB> Marker

If it's needed a
marker, description
of the marker



“Ecosystems on the Edge”



“climate change”

Hardware and
software needed:

pc, smartphone, tablet, camera.

Type of Augmented
data

Images; Text; Videos; 3D models

Written description
of the AR data

Students will begin the experience by scanning a marker or accessing an AR app on their mobile device or tablet. On their screen, the AR scenario start with a city square and a class with teacher and students.





One by one, students will explore 8 virtual scenes — from past to distant future — presented through static but immersive AR environments (like a medieval manor or coral reef).

In each scene, there is a character that asks them to make a good-wright or sustainability-related decision, it will increase the difficulties of the topic and also the questions.

The scenarios are connected each one another with the dialogue of the previous scenario and the next one is an enhancement of the topic but with another point of view or a different but specific aspect.

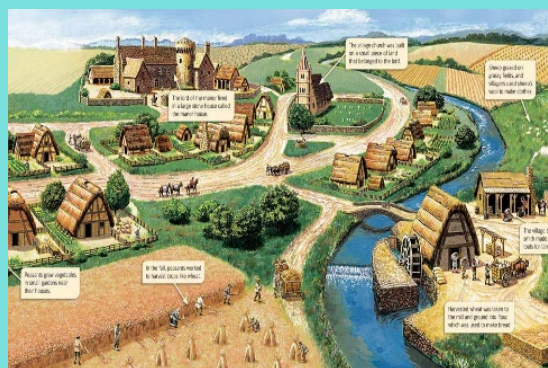
By tapping on virtual objects or icons, they unlock the hidden videos that are a plus, that can provide information for the quiz or enhance complex contents.

Each choice affects their score, and they can gain point or not adding points at all. After completing all 8 stages, students receive instant feedback in each one and a final score based on their overall impact.

The activity is done individually, but it can be useful even work in small group and it can start and end with a class discussion or brainstorming on the topic or reflection to compare results and share insights.

Also it can be possible to stop in stages, when they answer the questions for example, to provide new information or add some theory based on the next step.

If Image



Medieval Manor





Seychelles



Agenda 2030

If Text

T: Morning guys!

G: Hello teacher! A: Good Morning!

T: Today we'll talk about biodiversity and climate change. For example: In the Middle Ages, forests were vast and full of wildlife.

B: People depended on nature and respected the seasons

T: Exactly!

G: Teacher, can we role-play as country representatives and discuss our nations' problems?

T: Good idea! Let's do a competition! you'll have to choose the right answer to gain points and win. Let's go!

B: Teacher, I'd like to introduce the topic of the lesson by making a comparison with the past. Is that ok?

T: That's a great idea! History helps us understand how humans lived with nature in the past. Go ahead, tell us what life was like in medieval times.

B: In medieval times, people lived in castles, called manors. Around them there were fields, forests, and many animals that





were essential for food and work...

K: Welcome, travellers! You stand before a medieval castle, also known as a manor. Look around, noble guests, and behold how we live in harmony with animals and plants within these walls.

N: Hey there! Who are you?

C: I'm a herald

I: Who's there?

O: we're travellers

K: Let's show you a picture of what we are talking about our daily lifestyle here... Now that you've seen the medieval manor, are you ready to answer a question about life in those times?

Q: In the Middle Ages, what was the main source of energy?

- a. Solar power +0 pt
- b. Wind, water, and fire +10 pt
- c. Nuclear power +0 pt

If correct K: correct

If wrong K: incorrect. You better work hard for the next one, Traveler!

K: Your score is ... X Points

T: Oh well, guys, who wants to be next?

G: Me! I chose Australia and the coral reef

B: Ehm...

G: I want to show you a short video. Click on me. (start video)

S: click on me... (start video)

D: Hello!

I: WOW! Look at those corals! Their turning white!

D: I wonder... What is the cause of this?

W: It's really sad to see the corals dying...

Q: What is the main cause of coral bleaching?

- a. Warmer and more acidic oceans +10 pt
- b. Overfishing +0 pt





c. Less sunlight +0 pt

D: Bet your score is ... X Points

T: Well good job, next one?

G: Me! I want to talk about the Seychelle islands!

Text appear "Seychelles Islands Now" (Image is shown)

T: What do you think about this future scenario?

G: Mh. Let's see...

Text appear "Seychelles Islands in the near future" (Image is shown)

T: Let's think of the near future. How will things change?

Q: Will things change for better or for worse if we don't try to change the bad habits people have right now?

a. Better +0 pt

b. Worse +5 pt

If correct T: That's right! So... X Points

T: Global warming causes sea levels to rise because glaciers and ice sheets melt, adding more water to the oceans, and because warmer water expands, taking up more space. This process is called thermal expansion, and it also makes the oceans rise.

G: In the Seychelles, sea level rise caused by global warming may make many small islands disappear, leaving only the biggest ones like Mahé.

B: It's really sad to think that, because of sea level rise, many of the Seychelles islands could vanish and only Mahé might remain.

S: Welcome everyone to Mahé the last of the Seychelles islands! Hudred years ago here were 115 islands, now this is what remains...

W: Really? it's unbelievable

M: You can't be serious!

S: But this is the truth we must face... Protecting islands and oceans is also part of our responsibility... Do you remember the 17 goals of the agenda 2030? The 2030 Agenda is a global plan created by the United Nations. It includes 17 goals to protect the planet, fight poverty, and ensure peace and prosperity for all. For example,





Goal 2 is about Zero Hunger, and Goal 3 is about Good Health and Well-being. These goals remind us that protecting people and the planet are connected. There was a goal, that was right for the small islands and exactly for these cases...

Q: Do you remember which Agenda 2030 goal focuses on Life on Land?

- a. Goal 15 +20 pt
- b. Goal 7 +0 pt
- c. Goal 2 +0 pt

S: Now that was difficult, you got double points! X Points

F: It's my turn! Let's think for example at the north pole and the animals that live here...

Text appear "TV": click on the tv (start video)

T: Let's try something difficult

Q: Which of these Arctic species is considered a keystone species, because its decline would severely affect the entire ecosystem?

- a. Arctic fox +0 pt
- b. Polar Bear +0 pt
- c. Krill +20 pt

If correct T: yes

If wrong T: not exactly

Text appear "TV": click on the tv (start video)

T: The correct answer is Krill. Krill are tiny crustaceans, but they are essential in the Arctic food chain. Many animals such as fish, seals, whales, and even polar bears depend on species that feed on krill. If krill populations decline because of climate change and melting ice, the entire ecosystem is at risk. X Points. Well, let's try to imagine the distant future now...

R: Hi everyone, welcome to the north pole! Look around! The icebergs have melted, and polar bears now stand on floating islands of plastic. This is the result of climate change and our failure to protect nature.

If scrolling on Polar Bear start video

Q: Why might polar bears live on plastic islands in the future?

- a. For fun +0 pt





- b. Loss of sea ice due to climate change +10 pt
- c. Migration patterns +0 pt

Q: Why does an increase in greenhouse gases raise the Earth's temperature?

- a. They allow more sunlight to enter the Earth's atmosphere.
- b. They trap infrared radiation and re-emit heat back to the surface.
- c. They produce their own energy like the Sun.

Correct: B +10 pt

Wrong: A, C +0 pt

Q: What happens to the Earth's albedo when ice and snow disappear?

- a. The albedo decreases and more energy is absorbed by oceans and land.
- b. The albedo increases and more sunlight is reflected.
- c. The albedo stays the same because clouds replace ice.

Correct: A +10 pt

Wrong: B, C +0 pt

Q: What is the main physical reason why sea level rise is also caused by warmer water?

- a. Water molecules contract when they get hotter.
- b. Water molecules expand and take up more volume as temperature increases.
- c. Heat transforms water directly into ice.

Correct: B +10 pt

Wrong: A, C +0 pt

R: X points

If video

<https://www.youtube.com/watch?v=lfh0wDESq3Q>

<https://www.youtube.com/watch?v=Jo6rcffwQLc>

<https://www.youtube.com/watch?v=jM2G7CkeKTI>

https://www.youtube.com/watch?v=_AabWZle7gs

<https://www.youtube.com/watch?v=inISRFxWIPY>





If audio

-

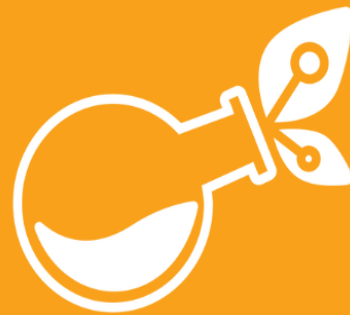
If 3D model

The formats needed are:.obj,. stl.





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