



Co-funded by
the European Union

Modelling the Impact of GMOs Through AR Exploration and Creation



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

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them."





Table of content

General Information	2
Pedagogical specifications	3
Technical specifications	4





General Information

Name of the exercise:	Modelling the Impact of GMOs Through AR Exploration and Creation
Description of the exercises:	In this two-phase exercise, students explore genetically modified organisms (GMOs) by first interacting with an existing AR-based test and then creating their own AR learning scenarios. In the first phase, learners analyze an interactive AR test that presents GMO-related situations, questions, and consequences. In the second phase, students design their own AR projects using Delightex, focusing on GMO topics and creating original questions that assess understanding and stimulate critical thinking. This exercise combines inquiry, analysis, creativity, and assessment to support deeper understanding of biotechnology and its real-world impact. Phase 1 – AR-Based Test (Assessment & Exploration) Teacher role: • Introduce the topic of GMOs briefly and explain that students will complete an AR-based test • Clarify that this phase includes scoring and feedback • Encourage students to focus on understanding <i>why</i> answers are correct or incorrect Student activity: • Students access the AR test (KNR-QAR) • They explore GMO-related scenarios and answer quiz questions • They receive scores and immediate feedback Pedagogical focus: • Diagnosing prior knowledge • Identifying misconceptions • Preparing students for deeper analysis Phase 2 – Student-Created AR Project (Application & Reflection) Teacher role: • Explain that students will now become content creators • Provide clear boundaries: simple AR scenes + a small number of questions (2–4) • Support topic selection and ensure scientific accuracy Student activity: • Students choose a GMO-related topic (e.g. GMO crops, biodiversity, food safety) • Using Delightex, they create a simple AR scene • Students design their own questions (with or without scoring) • Learners test each other's AR projects and discuss results





	Pedagogical focus: • Applying knowledge Developing evaluation and creation skills • Understanding how assessment tools are designed Recommended assessment approach: • Formative assessment during discussions and project development • Summative elements from AR test score (Phase 1) and Quality of student-created questions (Phase 2) Suggested evaluation criteria: • Accuracy of GMO-related content • Ability to explain benefits and risks • Quality and clarity of questions • Engagement in discussion and reflection Suggested guiding questions: • Which questions in the AR test were most challenging and why? • How did AR help you understand genetic modification better than text alone? • What did you consider when creating your own questions? • How can GMOs impact society differently depending on context?
Participants:	Secondary school students
Participants' age range:	14–18 years
STEM subject and specific topic:	Biology, IT, Chemistry, Biotechnology – Genetic engineering, GMOs and their impact
Gamification process:	Points for completing the AR test and analysis tasks Badges for creating original AR questions and scenarios Peer recognition for clear explanations and thoughtful questions
Written or graphic description of Augmented info:	The exercise includes interactive AR scenes illustrating GMO development, genetic modification processes, and potential impacts. In the second phase, student-created AR scenes include visual elements and embedded questions related to GMO benefits, risks, and ethical considerations.
External (or extra) tools required	Smartphone, tablet, or PC with camera, Internet connection





Co-funded by
the European Union

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

Delightex Edu platform: <https://edu.delightex.com>

Reference AR test: <https://edu.delightex.com/KNR-QAR>

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

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them."





Pedagogical specifications

Here we will collect information on how to use the exercise in the learning session and the results and benefits of using it, from a pedagogical perspective.

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

Genetic modification is an abstract and often controversial topic that is difficult to understand through text-based learning alone. Augmented Reality allows students to visualize invisible genetic processes and explore cause–effect relationships interactively. By first analyzing an existing AR test and then creating their own AR scenarios, learners move from passive consumption to active knowledge construction. This approach makes biotechnology more engaging, supports inquiry-based learning, and encourages students to think critically about real-world applications of GMOs.

Phase 1 – AR Test Exploration and Analysis:

Students interact with an AR-based test that models the impact of GMOs. They analyze how questions, scenarios, and visual elements are used to represent genetic modification processes and their consequences.

Phase 2 – Student-Created AR Project:

Using Delightex, students design a simple AR scene related to a GMO topic (e.g. GMO crops, pest resistance, biodiversity impact). They add visual elements and create their own questions (multiple-choice or reflective) that assess understanding and encourage discussion.

Scope of augmented information:

- 3D models
- Text-based questions and explanations
- Interactive AR elements

Goals achieved:

- Improve understanding of GMO development and impacts
- Support systems thinking and ethical reasoning
- Develop digital creativity and assessment literacy

Which pedagogical objectives are addressed through this scenario?

- Understand what GMOs are and how they are developed
- Analyze benefits and risks of genetic modification
- Develop critical thinking through scenario-based questions
- Learn how assessment tools are designed
- Improve digital, scientific, and communication skills

Which results are expected to be reached with its use?





Students are expected to:

- Explain GMO-related processes and impacts using AR-supported models
- Demonstrate deeper understanding through question creation
- Apply knowledge rather than memorizing facts
- Engage in informed discussion and reflection

Which benefits are expected to be reached with its use?

Disciplinary benefits:

- Clearer understanding of biotechnology and genetic engineering

Practical and sensory benefits:

- Enhanced visualization of genetic processes
- Increased engagement through interactive AR use

Social and ethical benefits:

- Improved collaboration and peer learning
- Increased awareness of ethical and societal aspects of GMOs





Technical specifications

In this part it is necessary to specify whether the exercise was designed to be implemented with AR technology. This part is fundamental for the translation process. Please include text, audio text and all the necessary materials.

AR INFORMATION	
Technology	Delightex (https://edu.delightex.com/Studio/Spaces)
If it's needed a marker, description of the marker	https://edu.delightex.com/KNR-QAR 
Hardware and software needed:	PC, smartphone, or tablet with camera and internet access
Type of Augmented data	Images, text, 3D models
Written description of the AR data	In the first phase, students interact with a pre-designed AR test that presents GMO scenarios and questions. In the second phase, students create their own AR scenes, embedding questions that explore GMO impacts and ethical considerations.
If Image	-
If Text	1. What is DNA (deoxyribonucleic acid)? A. <u>Genetic material in cells</u> B. Cell membrane





- C. A building block for proteins
- D. Energy source in cells

DNA is a molecule that contains the genetic information needed for organisms to develop, function and reproduce.

2. What is the role of enzymes in cells?

- A. Protects genetic information
- B. Transport of materials
- C. Gives structure to the cell
- D. Catalyses chemical reactions

Enzymes are proteins that speed up chemical reactions in cells, allowing them to happen efficiently and quickly.

3. What is polymerase chain reaction (PCR)?

- A. DNA copying method
- B. Method of cell division
- C. The process of protein synthesis
- D. RNA editing techniques

PCR is a technique used to make copies of DNA fragments, allowing rapid amplification of DNA sequences.

4. What does the term 'genetic engineering' mean?

- A. Growing cells
- B. Gene modification
- C. Protein analysis
- D. Synthesis of chemical compounds

Genetic engineering involves the manipulation of genetic material to change the characteristics of an organism.

5. What is a plasmid?

- A. DNA molecule in bacteria
- B. Part of the virus
- C. Human cell organelle
- D. Plant cell structure

Plasmids are small, circular DNA molecules found in bacteria and used in genetic engineering to transfer genes.

6. What is the role of restriction enzymes?

- A. Edits RNA
- B. Copies DNA
- C. Splices DNA fragments together
- D. Slices DNA in specific places

Restriction enzymes are used to cut DNA molecules into specific sequences, allowing genetic engineers to precisely manipulate DNA.

7. What is a ligase?

- A. Copies RNA
- B. DNA of Pilausto
- C. Splices DNA fragments together
- D. Synthesises proteins

Ligase is an enzyme that binds DNA fragments together to form a single DNA molecule.

8. What does the term 'transformation' mean in genetic engineering?

- A. Cell division
- B. Protein synthesis
- C. Inserting DNA into a cell
- D. RNA editing

Transformation is the process by which DNA is inserted into a cell, changing its genetic make-up.

9. What is gene therapy?

- A. Inserting genes into cells for treatment
- B. Growing cells in the laboratory
- C. Promoting protein synthesis
- D. Catalysing chemical reactions

Gene therapy involves inserting genes into cells to treat genetic diseases or other health





problems.

10. What is the role of CRISPR-Cas9?

- A. DNA copying method
- B. The process of protein synthesis
- C. Method of cell division
- D. Gene editing technology

CRISPR-Cas9 is a gene-editing technology that allows precise changes to DNA sequences in organisms.

1. What is biotechnology?

- A. Study of chemical reactions
- B. Use of biological systems
- C. Developing mathematical models
- D. Applying the laws of physics

Biotechnology involves the use of biological systems such as cells and enzymes in industry, medicine and agriculture.

2. What is the definition of a genetically modified organism (GMO)?

- A. Altered genome
- B. An organism without a nucleus
- C. Naturally growing organism
- D. Sterile body

A GMO is an organism whose genetic material has been altered using genetic engineering techniques.

3. What is the main purpose of GMOs in agriculture?

- A. Reduce food prices
- B. Reduce water use
- C. Improve soil quality
- D. Increase yields

The main purpose of GMOs in agriculture is to increase yield, pest and herbicide resistance.

4. What are the potential environmental risks of GMOs?

- A. Increasing soil fertility
- B. Reducing air pollution
- C. Loss of biodiversity
- D. Improving water purity

GMOs can pose risks to the environment, including the loss of biodiversity and the spread of herbicide resistance.

5. What is the purpose of gene therapy?

- A. Stop ageing
- B. Improve memory
- C. Increase muscle mass
- D. Treat genetic diseases

Gene therapy aims to treat genetic diseases by inserting healthy copies of genes into the patient's cells.

6. Who is V. Šikšnys?

- A. Physics
- B. Chemist
- C. Mathematician
- D. Biotechnologist

Virginijus Šikšnys is a renowned Lithuanian biotechnologist who has contributed to the development of CRISPR Cas9 gene editing technology.

7. What is the use of CRISPR-Cas9?

- A. Energy production
- B. Protein synthesis
- C. Growing cells
- D. Gene editing

The CRISPR-Cas9 system is used for gene editing, allowing precise changes to DNA sequences in organisms.

8. What products can be developed using biotechnology?





	A. Plastics B. <u>Vaccines</u> C. Coal D. Glass Biotechnology can be used to develop a wide range of products, including vaccines, insulin and genetically modified plants. 9. What is the advantage of herbicide resistance in genetically modified plants? A. Higher yields B. <u>Easier weed control</u> C. Pest resistance D. Reduced water demand Genetically modified herbicide-resistant plants allow farmers to control weeds more effectively by using herbicides that do not harm the crop. 10. What are the ethical issues raised by the use of GMOs? A. <u>Impact on biodiversity</u> B. Yield increase C. Saving water D. Food price falls The use of GMOs raises ethical issues related to potential impacts on biodiversity, human health and economic inequalities.
If video	-
If audio	-
If 3D model	.obj, .stl (available in Delightex Edu library)





Co-funded by
the European Union



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-00026516

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Education and Culture Executive Agency (EACEA). Neither the European Union nor EACEA can be held responsible for them.