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Designing a Functional Organ: Why Structure Matters

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

KIT Karlsruher Institut für Technologie · ktu kaunas university of technology · Università degli Studi di Palermo · CEIPES · Eduact

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Table of content

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

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General Information

Name of the exercise:	Designing a Functional Organ: Why Structure Matters
Description of the exercises:	IIn this exercise, students explore a 3D interactive organ model using Augmented Reality to understand why biological structures must be designed as integrated systems. By manipulating layers and components in a Delightex AR environment, learners investigate how structure, function, and connectivity determine whether an organ can work properly. The activity highlights why lab-grown organs must replicate not only shape, but also biological organization. **Lesson Flow (3E Methodology):** Introduction. Start with a guiding question: “If we can 3D print objects, why is it so difficult to print a working human organ?” Briefly remind students of stem cells, tissue regeneration, lab-grown organs. **Explore** – AR Investigation. Students open the Delightex project and explore the organ model in AR. Guide them to rotate and zoom the model, observe layers and internal structures, identify different components. Guiding questions: What parts make up this organ? How are these parts connected? What might happen if one part does not work? **Execute**. Structure–Function Challenge. Students work in groups and discuss “Which components are essential for this organ to function properly?” They categorize components as Essential, Important, Optional, Encourage justification of choices. **Discussion and Reflection**. Groups briefly share whether their organ design would work, which component was most critical, what makes lab-grown organs challenging. Link discussion to real-world regenerative medicine and future technologies. **Extension and Connections**. This lesson can be extended by linking to the exercise “Should We Print Organs?” (ethics), comparing AR models with real medical case studies, assigning a short reflection or debate task. This exercise helps students understand that printing an organ is not about copying a shape, but about recreating a living, interconnected system. Augmented Reality supports this understanding by making invisible biological complexity visible and interactive.
Participants:	Students (small groups of 2–3)
Participants’ age range:	14–18 years

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

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STEM subject and specific topic:	Biology, Biotechnology, Medicine Topic: Organ structure, functional systems, regenerative medicine
Gamification process:	• Points for correctly identifying essential organ components • Badges (e.g. Systems Thinker, Tissue Designer) • Final challenge: decide if the organ model would function in real life
Written or graphic description of Augmented info:	Layered 3D organ models displayed in AR, allowing students to enable or disable structural components and observe consequences.
External (or extra) tools required	Smartphone, tablet, or PC with camera, Internet connection
Links (video, images, text online and so on).	Delightex Edu platform: https://edu.delightex.com Link to AR project: https://edu.delightex.com/VAJ-TTA

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?

Augmented Reality allows students to explore organs as living systems, not static diagrams. By interacting with layered models, learners can see how removing or altering one component affects the entire system. This makes abstract concepts such as structure–function relationships and biological integration more concrete and engaging.

Students open the Delightex AR project and explore the organ model in 3D. They:

- activate and deactivate layers (e.g. tissue, vessels, internal structures),
- rotate and zoom the model to examine spatial relationships,
- discuss what happens when key components are missing or misaligned.

The teacher guides students through reflection questions linking these observations to lab-grown organ design.

The augmented information includes **interactive 3D layers, labels, and guided prompts,** supporting inquiry-based learning.

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

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Which pedagogical objectives are addressed through this scenario?

- Understanding organs as interconnected biological systems
- Recognizing the importance of structure–function relationships
- Developing systems thinking and spatial reasoning
- Connecting biological complexity with challenges in regenerative medicine

Which results are expected to be reached with its use?

Students are expected to:

- identify essential components required for organ function,
- explain why shape alone is not enough for a functional organ,
- apply systems thinking to real-world biomedical challenges.

Which benefits are expected to be reached with its use?

- High engagement through interactive exploration
- Improved conceptual understanding of organ complexity
- Stronger connection between biology and biomedical engineering
- Enhanced collaboration and discussion skills

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	Augmented Reality using Delightex (https://edu.delightex.com/Studio/Spaces)

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

If it's needed a marker, description of the marker	VAJ TTA https://edu.delightex.com/VAJ-TTA
Hardware and software needed:	PC, smartphone, or tablet with camera and internet access
Type of Augmented data	3D models, layered structures, text labels
Written description of the AR data	Students interact with layered organ models in AR to explore how structure, connectivity, and organization affect function. By selectively modifying the model, they simulate design decisions relevant to lab-grown organs.
If Image	-
If Text	-
If video	-
If audio	-
If 3D model	.obj, .stl (available in Delightex Edu library) https://edu.delightex.com/VAJ-TTA

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