

***Human Anatomy. Support and movement. The human musculoskeletal system***  
**– VEGA Teaching Scenario**

**Topic:** Familiarise students with the skeletal and muscular system in humans and animals, and enhance their understanding of the relationship between the different organs.

**Subject(s):** Biology

**Age / Grade:** 12-13 years old (1st class of secondary school) and/or 15-16 years old (1<sup>st</sup> class of high school)

**Short description of the VR and AR games in this scenario:**

- [3D Organon VR Anatomy](#)

The App includes Female and Male human systems, skeletal system, muscles, vessels, nerves, and other organs in 3D. (Experience duration: around 30 minutes playtime). The app features an extensive knowledge-base of anatomical definitions with terminology based on the official Terminologia Anatomica. 3D Organon is used by hundreds of leading universities and hospitals worldwide. Its educational advantages include gamification of learning, owing to the fact that students find the experience stimulating, engaging, and entertaining. The 3D models in 3D Organon can add important cognitive input which enhances the in-depth understanding of key anatomical concepts and retention of knowledge. 3D Organon integrates advanced teaching tools that could complement any anatomy curriculum.

Apps from App Lab haven't gone through the full Oculus review process, so they may include unknown issues relating to comfort, performance, or other factors.

The free version provides access to the skeletal system only.



- [Anatomy AR – A view of the human body](#)

Anatomy AR is an augmented reality application of the human body and its components (bone system, nervous system, muscular system, organs, etc) on a real scale with indications and notes for the study and learning of university students focused on the teachings of Medicine. The app contains the following systems: articular, cardiovascular, digestive, endocrine, genital, integumentary, lymphatic, muscular, nervous, bone, respiratory, sensory, urinary. The APP offers three modes:

1. **3D virtual view mode** where the user can see the human body model in the screen space.
  - select each of the elements to see more information about it in the panel.
  - Pinch to zoom in or out of the human body.
  - Drag to rotate the view of the human body.
  - Activate or deactivate the different systems with the buttons at the top.

2. **Augmented Reality (ARCore)** in which users can place the model on a surface in the real world for an immersive experience.

- select each of the elements to see more information about it in the panel.
- Pinch to increase or decrease the size of the human body.
- Gesture rotate to rotate the human body.

3. **Augmented Reality (Image Tracking)** in which the user can see the model on a target image for an immersive experience (requires printing the image). The image can be downloaded from <https://bit.ly/anatomy-ar>.

- select each of the elements to see more information about it in the panel.
- Pinch to increase or decrease the size of the human body.
- Gesture rotate to rotate the human body.

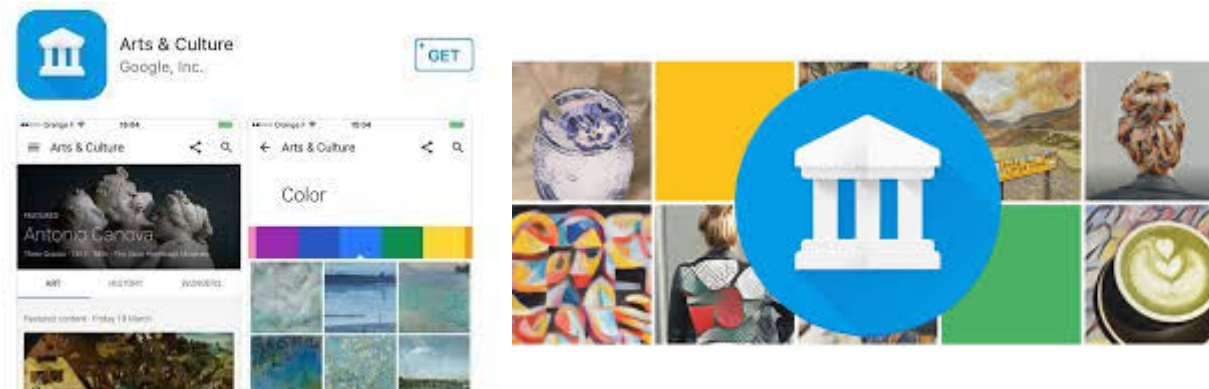
---

FYI there is only one detailed model (Male) in the app and it's not available in the Greek language.



- [Google Arts and Culture App](#)

Google Arts & Culture puts the treasures, stories and knowledge of over 2,000 cultural institutions from 80 countries at students' fingertips. From the suffragettes who fought for women's rights, to performing arts at the Paris Opera, to NASA's archive of stunning images, students can discover stories about our cultural heritage. It's a doorway to explore the art, history, people and wonders of our world.



**Introduction to the scenario:**

In this scenario three apps (3D Organon - VR Anatomy, Anatomy AR- Aview of the Human Body, and Google Arts and Culture App) will be used to teach students how the skeletal and muscular systems cooperate in the production of movement. The human body movement will be associated with the animals' body movement resulting in a deeper understanding of the common aspects that bond us with the animal kingdom and the need to respect and protect them as an esencial part of our life on Earth.

## **Learning outcomes:**

The students are able to:

- Recognise the difference between motion and movement
- Justify why organisms need to move
- Detect differences between the skeleton and movement of various organisms
- Recognise movement as the result of cooperation between the skeletal and muscular systems and explain the role of each in the humans' movement
- Describe the basic bones' structural characteristics and group them according to their morphology
- Describe the skeleton's function and relate it with the general function of an organism
- Recognise the different joints
- Name the different kinds of muscles and their role in the conscious and unconscious movement
- Justify the contribution of exercising for the wellbeing of human organism

## **A selection of learning outcomes from the Cypriot Curriculum:**

- Developing students' ability to recognise the basic organs of the human body, locate their position in the human body as well their basic function;
- Enhancing students' understanding of the existing relationship between the organs of an organic system;
- Improving students' ability to name the basic organs of the human body;
- Facilitate students' comprehension regarding the relationship between the different systems of organs in the human body;
- Familiarise students with the concept of a system in the living and non-living world
- Using modern technologies in a productive way for the study of biology science.

## **Formative assessment**

**Number of students:** 15 (3 per group)

**Duration:** 7 lessons of 40-45 min each

**Prerequisites:**

1. VR glasses with the application "3D Organon VR Anatomy"
2. Check that the internet is working
3. Information to introduce the students to the topic and accompanying materials (videos, pictures, etc.)

**Before the program begins (preparatory work for teacher):**

- Familiarise yourself with the "3D Organon VR Anatomy" app and learn how to operate the controllers  
Read information [https://www.oculus.com/experiences/quest/6218475558223281/?utm\\_source=sidequest](https://www.oculus.com/experiences/quest/6218475558223281/?utm_source=sidequest):
- Familiarise yourself with the AR Anatomy-A view of the human body  
Read information here <https://play.google.com/store/apps/details?id=com.ChutoEskills.ARAatomy&gl=ES>
- Ensure that the VR glasses and remote controls are fully charged
- Divide the students into work groups and assign their tasks
- The teacher should prepare the students emotionally about the intensity of the content to be viewed.
- The teacher divides the student into working groups (with equipment; up to 3) and discussion groups (up to 5 persons).

**The main part of the scenario:**

**Part one (2 lessons of 40-45 minutes):**

**Lessons 1&2:**

**Preparations:**

- The teacher is advised to use photos of a bow and slingshot to explain to the students how the skeletal and muscular system cooperate and produce movement.

**Learning sessions:**

The teacher divides the students into smaller groups and asks them to discuss the question of which systems contribute, according to their opinion, in the movement of the human body. The purpose of this question is to address misconceptions that students might have regarding the systems that contribute to the generation of movement. Some students believe that only the muscular system is responsible. They can't associate the movement as a result of the cooperation between the two systems and that muscles are connected to the bones.

Using the example of a bow and slingshot the teacher can explain that movement is the result of cooperation between soft and flexible organs that expand or contract and hard organs that provide support and resistance to movement. The teacher also explains the various types of skeletons in organisms and the parts of the skeleton and the muscles associated with them in the human body.

The presentation of the human musculoskeletal system will be done using the 2) Anatomy AR – A view of the human body. The teacher will divide students into groups of 3 and provide them with mobile phones where the AR App will be already downloaded. Students will follow the teacher's presentations using their Apps.

**Debriefing:**

After the teacher finishes with the presentation of the skeleton and the muscles associated with it, students will be divided into two teams and play a True or False game with questions related to the subject taught. The teacher can ask the questions orally or use Kahoot.

**Part two (3 lessons of 40-45 minutes):****Lessons 3-5:****Preparation:**

- Bring the VR glasses and check that they are charged
- Cast the VR Glasses to a computer and the projector

**Learning sessions:**

- Introduce VR glasses and explain the VR App for the Human Anatomy that they will use
- Students get to know how the glasses and controllers work
- Let the students try the functions of the controllers in turns (Cast the VR to computers so the other students can watch)
- When the students have an idea about how the basic functions work, they start exploring the Human Anatomy App in turns.

**Debriefing:**

After all students have familiarised themselves with the VR App functions, the teacher can initiate competition among groups of students. The teacher will name the skeleton parts and students' groups will have to find them in the App. The group that finds the items fastest and correctly, will be the winner.



## **Part three (2 lessons of 40-45 minutes)**

### **Lessons 6 & 7:**

#### **Preparation:**

- Check that there is internet connection
- Have a PC available and projector [in case any further equipment/ props are required, the students should talk with the teacher in advance]

#### **Learning sessions:**

Divide students into groups of 3-5 members. Depending on the number of students and groups, the presentations can range from 10 minutes (if 4 groups) or 15 minutes (if 3 groups).

#### **Debriefing:**

Students will be asked to visit the American Museum of Natural History of New York using the Google Arts and Culture App. They will have to find images of animal skeletons and find common elements between the humans' and animals' skeleton systems.

The groups will need to present their findings in the class.

**Summative assessment:**

Grades 5-10	5	6	7	8	9	10
Activity and engagement	The student has had challenges to get the task finished. The student hasn't shown signs of engagement neither at school nor at home.	The student has only occasionally shown interest in the work and has had difficulty finding motivation.	The student has mostly shown interest in the work both at home and at school.	The student has shown interest and commitment to the work both at home and at school.	The student has shown great interest and commitment both in lessons and at home.	The student has shown great interest, responsibility and commitment both in lessons and at home.
The overall picture of the work when completed.	The student misses several parts of his work and several points are not checked in the list.	The student lacks several parts of the checklist in his work.	The student lacks certain parts of the checklist, but it is largely complete.	The student has done all the parts on the checklist.	The student has done all the parts on the checklist and you can see that the student has made an effort to include all the parts.	The student has done every single part on the checklist and it can be seen that the student has processed the content.

<p>The mindmap: Text structure, spelling and layout of text.</p>	<p>The mind map lacks important parts and lacks headings. The student uses a limited number of words and the variation is poor. The student needs a lot of support to complete the task in view of the digital skills required. The task is full of spelling and language errors.</p>	<p>The student has challenges with the content in the mindmap and lacks headings. The student uses a limited number of words and the variation is not great. The student needs support to complete the task in view of the digital skills required. The task is full of spelling and language errors.</p>	<p>The student's mind map includes the basic things but lacks some important facts . In most places, the student has a heading where the task so requires. The student has certain shortcomings in the digital skills that the task requires. The student has several places of negligence and not corrected spelling errors.</p>	<p>The student's mind map includes the most important things. The student uses headings and can reflect on his word choices. The student has the digital skills that school work requires, knows the standards for basic spelling and the structures of written language and can use them in text production.</p>	<p>The content of the mind map is complete. The student has creative headings and can reflect on their word choices in many ways. The student has the digital skills that the task requires. The student knows the norms of basic spelling and the structures of written language and can use them in a versatile way in their mind map.</p>	<p>The mind map has all the content that is requested and is structured in a way that shows that the student masters the subject. The text is put together in a versatile way. The student uses a versatile language and varies his words. The student knows the norms of basic spelling and the structures of written language and can use them in a versatile way in text production.</p>
<p>Images and captions</p>	<p>The student lacks pictures.</p>	<p>The student has few pictures and no captions.</p>	<p>The student has pictures but no captions.</p>	<p>The student has pictures with accompanying text.</p>	<p>The student has several pictures and descriptive captions.</p>	<p>The student has versatile pictures and descriptive and explanatory text.</p>

<p>Showing responsibility for the completion of the work. Cooperation and peer response</p>	<p>The student had difficulty cooperating with his group and did not listen to his classmates. The student did not give a peer response and did not take into account what the group gave in response.</p>	<p>The student had some difficulties in cooperating with his group and listening to his classmates. The student gave peer feedback without following the instructions. The student did not take into account the response given by the group.</p>	<p>The student mostly cooperated well with his group. The student received and gave feedback from his group almost always according to the instructions. The response was mostly constructive.</p>	<p>The student showed responsibility and mostly a good ability for cooperation. The student received and gave feedback from his group. The response was constructive.</p>	<p>The student showed evidence of good responsibility and a good ability for cooperation. The student gave a versatile response and took the response he / she received from his / her group into account.</p>	<p>The student showed evidence of excellent responsibility and an excellent ability for cooperation. The student made an effort to formulate himself in a constructive and valuable way for the task in order to help his group further in his work. The student received a response from his group and took it into account in his own work.</p>
<p>Skills</p>	<p>The student shows obvious shortcomings in the understanding of the subject.</p>	<p>The student shows some shortcomings in the understanding of the subject.</p>	<p>The student shows evidence of a certain understanding and some learned knowledge of the subject. .</p>	<p>The student shows evidence of a good understanding and has assimilated the most important content in the subject.</p>	<p>The student shows of an excellent understanding and has assimilated the most important content in the subject but lacks some knowledge.</p>	<p>The student shows evidence of an excellent understanding and fully masters the content.</p>

Language learning/English	The student has big difficulties in learning the English words.	The student struggles with and has some challenges with the English words.	The student knows the most important concepts and words in English.	The student shows evidence of understanding most parts In English.	The student has a good understanding and has learned most of the concepts and knows all the words in English.	The student masters all concepts and words in English.
The VR part and the app use	The student presents obvious difficulties in understanding how the 3D Organon VR Anatomy and Google Arts and Culture apps work. Shows a lack of interest and is careless in the use of equipment needed.	The student presents some difficulties in understanding how the 3D Organon VR Anatomy and Google Arts and Culture apps work. Trying to do according to the instructions, but can not keep the interest up all the time. The student is sometimes careless in the use of equipment needed.	The student understands the main features of how the 3D Organon VR Anatomy and Google Arts and Culture apps work. Mostly follows the instructions, but sometimes lacks perseverance. Is usually careful with the equipment.	The student shows a good understanding of how the 3D Organon VR Anatomy and Google Arts and Culture apps work. The student always follows the teacher's instructions and is careful with equipment.	The student shows an excellent understanding of how the 3D Organon VR Anatomy and Google Arts and Culture apps work. Always follow the teacher's instructions and is very careful with the equipment.	The student masters the use of the 3D Organon VR Anatomy and Google Arts and Culture apps. Always follow the teacher's instructions and help their classmates. Always be careful with technology.