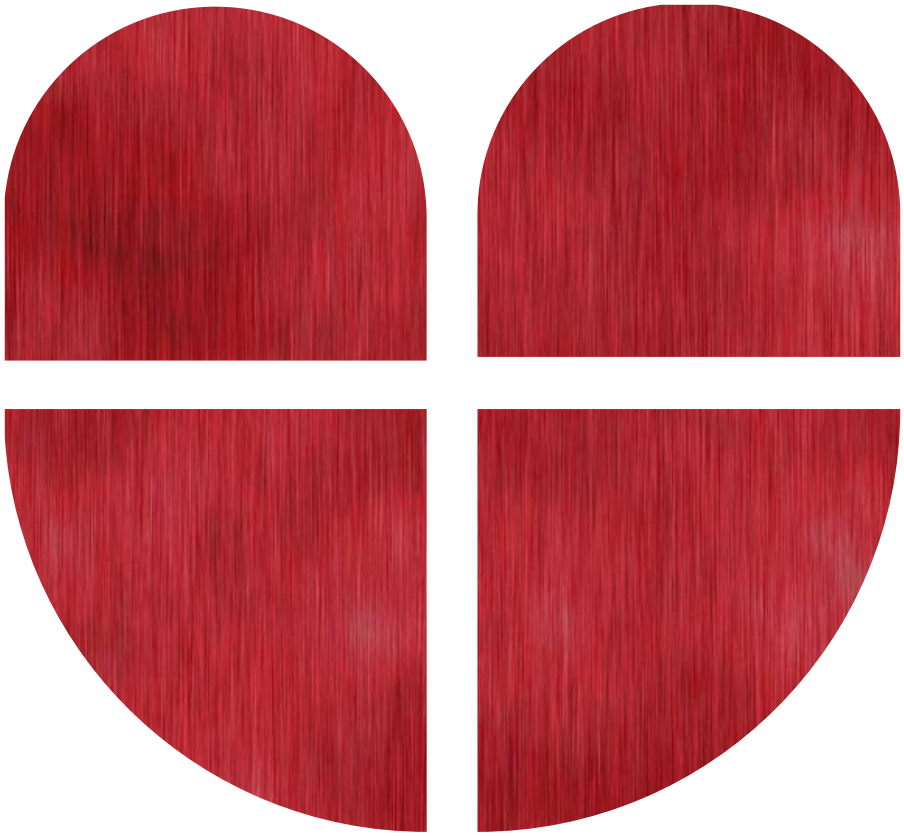
OrganKits
for STEAM

Co-funded by
the European Union



EDUCATIONAL GUIDE
to implement **OrganKits**

CARDIOHEALTH &EMOTIONS

organkitsproject.eu

CARDIOHEALTH&EMOTIONS

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TEACHERS INVOLVED IN THE DESIGN OF THIS EDUCATIONAL GUIDE

NAME	SECONDARY SCHOOL	SUBJECT
Hayri Padak	Bahcesehir High School (Turkey)	Literature
Özgür Kurt	Bahcesehir High School (Turkey)	English
Buket Kelebek	Bahcesehir High School (Turkey)	Biology
Gözde Kanat	Bahcesehir High School (Turkey)	Chemistry
Taylan Yerlikaya	Bahcesehir High School (Turkey)	PE
Seçil Bas	Bahcesehir High School (Turkey)	Art
Hediye Orman	Bahcesehir High School (Turkey)	Mathematics
Öznur Akçam Yılmaz	Bahcesehir High School (Turkey)	Literature
Giannis Papadopoulos	Platon School	Physics
Nikos Gkontas	Platon School	Mathematics
Ilias Batzogiannis	Platon School	Physics-Chemistry
Evgenia Moysidoy	Platon School	Literature

RESEARCH TEAM (UNIVERSITY OF MURCIA)

NAME	EMAIL
González-Calatayud, Victor	victor.gonzalez@um.es
Gutiérrez-Porlán, Isabel	isabelgp@um.es
Latorre Reviriego, Rafael	latorre@um.es
López-Albors, Octavio	albors@um.es
Prendes-Espinosa, M Paz	pazprend@um.es
Ruiz-Montiel, Francisco J.	franciscojose.montiel2@um.es
Solano-Fernández, Isabel M.	imsolano@um.es

PROJECT

- [ ] SPORT-HEALTH
- [ ] NEUMO-HEALTH
- [ ] MENTAL-HEALTH
- [x] CARDIO-HEALTH
- [ ] NUTRI-HEALTH
- [ ] REPRO-HEALTH

LEARN-STEM MODEL

- [x] Complex
- [x] Progress-oriented
- [x] Holistic
- [x] Practical
- [x] Social

KEY COMPETENCES OF THE PROJECT

- [x] Literacy
- [x] Multilingual
- [x] Mathematics, Science, Technology & Engineering
- [x] Personal, social and learning to learn
- [ ] Citizenship
- [ ] Entrepreneurship
- [ ] Cultural awareness

SUSTAINABLE DEVELOPMENT GOALS OF THE PROJECT

- [ ] No poverty
- [ ] Reduced Inequality
- [ ] Zero Hunger
- [x] Sustainable Cities and Communities
- [x] Good Health and Well-being
- [ ] Responsible Consumption and Production
- [x] Quality Education
- [ ] Climate Action
- [ ] Gender Equality
- [ ] Life Below Water
- [x] Clean water and Sanitation
- [ ] Life on Land
- [ ] Affordable and Clean Energy
- [ ] Peace and Justice Strong Institutions
- [ ] Decent Work and Economic Growth
- [ ] Partnerships to achieve the Goal
- [ ] Industry, Innovation and Infrastructure

SUBJECTS OF THE CURRICULA worked in this project:

- [x] Mathematics
- [x] Language
- [ ] History
- [x] Biology
- [x] Physical Education
- [x] Art
- [x] Technology

GENERAL DESCRIPTION OF THE PROJECT:

Use of plastination can minimise health risks and cost in anatomy laboratories. Plastinated organs are easy to use and can facilitate learning of complex anatomical structures. Therefore, we aimed to evaluate the contribution of plastinated organ kits to teaching the complex anatomy of the body, more specifically of the respiratory system for our school.

2D educational materials such as textbooks, illustrations, and digital images may also be of limited benefit in understanding the three-dimensional complexity of anatomy and spatial relationships of structures. Plastination is a great method for long-term preservation of anatomical specimens.

With plastination, it is possible to preserve anatomical materials in a durable, aesthetic and realistic way. Therefore, plastinated specimens are valuable in anatomy teaching. For this reason, it is primordial to make interdisciplinary correlations between the respiratory system and the environment.

We can carry out these studies as a whole with interdisciplinary connections. These disciplines will be explained by establishing the connection between the respiratory system and daily life through disciplines such as biology, chemistry, mathematics, art, and physical education.

SPECIFIC STUDENTS' COMPETENCES TO DEVELOP (LEARNING OUTCOMES)

Learning through the Gestalt theory

Generate creative ideas

Interdisciplinary learning and teamwork

Analytical thinking Skills

Problem solving skills

Learn Cause- Effect relationship

Providing scientific arguments

Note Taking Skills

Time Management Skills

Develop Language Skills

Ability to prepare and make presentation

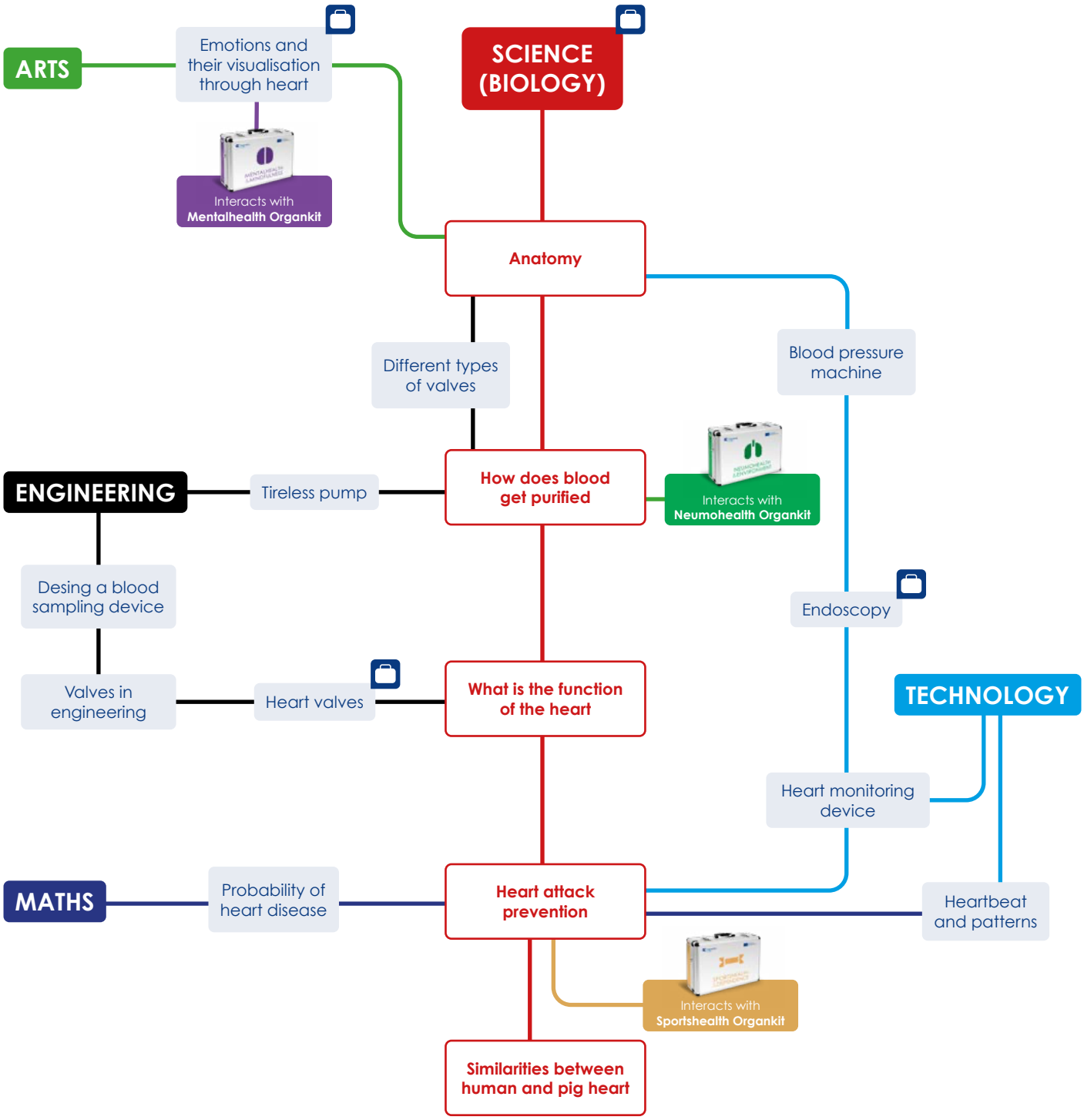
Improve Communication Skills

DESCRIPTION OF EACH TASK: TEACHERS WILL DEVELOP THE PLAN OF EACH TEACHING

The heart is a remarkable organ that plays a vital role in the human body. In this educational guide, we will delve into the world of the heart using a STEAM approach, combining Science, Technology, Engineering, Arts, and Mathematics. By asking and exploring these questions, not only will the students gain a deeper understanding of the heart's structure and function, they will explore the intricate relationship between the heart and emotions. We will delve into the science of the heart's structure and function, the technology used for studying it, the engineering aspects of the heart as a tireless pump, the artistic representations and cultural significance of the heart, and the mathematics behind quantifying heart data.

This STEAM guide offers a multifaceted exploration of the heart and emotions, from its scientific and technological aspects to its cultural representations, artistic expressions, and mathematical quantification. By following this guide, students will gain a deep understanding of the heart and how emotions affect it, fostering a holistic approach to learning.

PROJECT MAP



* This activity uses the OrganKits case.

SCIENCE

LEARNING UNIT 1: ***UNDERSTANDING THE HEART***

1. WHAT IS THE STRUCTURE OF THE HEART?

- Describe the heart's anatomy, including chambers, valves, and blood vessels.
- Discuss the heart's role in the circulatory system.

Understanding the heart's anatomy is crucial, and for teenagers, engaging activities combined with thought-provoking questions can make the subject more accessible and exciting.

TASK 1. ANATOMY OF THE HEART

OBJECTIVES

- Communication
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What structures did you observe in the heart from the outside to the inside?
- What are the main parts of the heart, and what functions do they serve?
- Which parts of the heart are associated with the arteries and veins that bring blood to the heart?
- How does blood flow through the heart and the circulatory system?
- Are the wall thicknesses of arteries and veins different? Why?
- How would you explain the ventricular wall of the heart being thicker than the auricular wall?
- Were we able to observe the valves in the heart?
- What is the function of valves in the heart?
- What role does the heart play in delivering oxygen and nutrients to the body's cells?

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

2 sessions

PROCESS

First, the organkits, the heart organ, is given to each student group.

In a given timeframe, students examine the heart and observe its structures. Afterwards, the students are asked questions about the heart. With help of the organkits, students will observe the valves of the heart chambers and the entry and exit positions of the veins.

Students from the different campuses will play an online Kahoot game against each other in real time. The questions will tbe in relation to the heart anatomy.

RESOURCES

- Cardiohealth OrganKit.
- Smartphone/video camera.
- Textbooks
- Reliable source of information from the internet.
- Assessment and Evaluation

Video

Info

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	20
Analysing scientific collected information	20
Using the appropriate scientific language	10
Presentation of the information	10
Reporting of the resources used & its reliability	10
Timely execution of the tasks	20
Ability to achieve targeted goals	10

2. HOW DOES BLOOD GET PURIFIED?

• Describe the purification process, including gas exchange in capillaries.

TASK 2. HOW DOES BLOOD GET PURIFIED?
(GREAT BLOOD CIRCULATION AND MINOR CLAN CIRCULATION)

OBJECTIVES

- Communication
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- How does the small and large blood circulation occur?
- How does blood flow through the heart and the circulatory system?
- What is the path of blood through the heart and the circulatory system?
- How does oxygenated and deoxygenated blood move through the body?
- What role do arteries, veins, and capillaries play in blood circulation?
- What role does the heart play in delivering oxygen and nutrients to the body's cells?
- How do nutrients and oxygen get transported to the body's cells via the circulatory system?
- What happens to waste products like carbon dioxide?

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

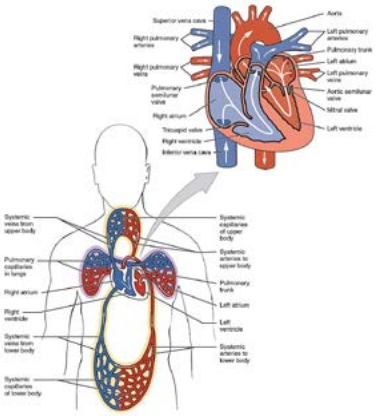
3/4 sessions

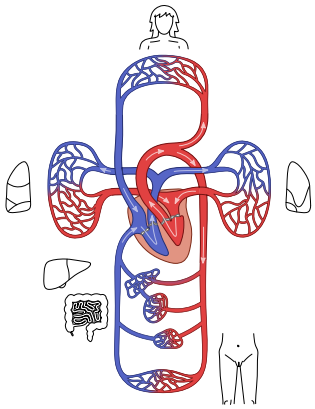
PROCESS

- First of all, students will analyse the structure of the organkits by using the actual organkit and will look at the various organkits of the heart.
- Then Students will watch videos about the process of cleaning the blood.
- Then Students will produce 3d models of the blood circulation using led lights.
- Flowchart or Diagram Creation: students create flowcharts or diagrams illustrating the journey of blood through the heart and the circulatory system.
- Integrate Cardiohealth and Neumohealth by developing a model demonstrating both pulmonary and systemic circulation using household materials or 3D printing, showcasing the flow of blood.

PROCESS

Video 1 | Video 2 | Video 3





Link | Link

RESOURCES

- LED light
- Styrofoam
- Battery
- Colored pencil
- Color copies of the heart and other organs
- Cuter
- Scissors
- Cardboard
- Tape
- Silicon
- Glue

Video 1

Video 2

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	30
Presentation of the information	40
Reporting of the resources used & its reliability	10
Timely execution of the tasks	10
Ability to achieve targeted goals	10

3. WHAT IS A HEART ATTACK, AND HOW CAN IT BE PREVENTED?

- Define a heart attack and its causes, emphasizing the role of blocked arteries.
- Explore preventive measures, including a healthy lifestyle and early detection.
- Create a simple heart model or simulation.
- Engage in a hands-on project to construct a basic heart model or use online simulations.

TASK 3. WHAT ARE THE FUNCTIONS OF THE HEART?

OBJECTIVES

- Communication
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What is the main function of the heart?
- What structures did you observe in the heart from the outside to the inside?
- What are the main parts of the heart, and what functions do they serve?
- Which parts of the heart are associated with the arteries and veins that bring blood to the heart?
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- Are the wall thicknesses of arteries and veins different? Why?
- How would you explain the ventricular wall of the heart being thicker than the auricular wall?
- Were we able to observe the valves in the heart?
- What is the function of valves in the heart?
- What role does the heart play in delivering oxygen and nutrients to the body's cells?

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

3 sessions: Gather info, make an experiment, present their experiment.

PROCESS

• Students will gather information about the main function of the heart by visiting trusted websites, using their course book and information given by their teachers.

• Students will prepare an experiment to demonstrate how the heart works. They have the freedom to conduct the experiment of their choice after getting their teachers approval.

• Finally the students will present their experiment to the other classmates.

Blood Circulation Role-play: (extra activity)

Divide students into groups representing different components of the circulatory system (heart, blood cells, vessels) and act out the flow of blood through the body.

RESOURCES

- Bottle
- Pipette
- Water
- Food coloring
- Tape
- Play dough
- Glass jar
- Glass

Video 1

Video 2

Exploratorium

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	30
Presentation of the information	40
Reporting of the resources used & its reliability	10
Timely execution of the tasks	10
Ability to achieve targeted goals	10

TASK 4. SIMILARITIES BETWEEN THE HUMAN AND PIG/ANIMAL HEART

OBJECTIVES

- Understand the structure and functions of the human heart
- Explore the similarities and differences between human and pig hearts using the plastinated heart taken by pig/ other animal.
- Understand the importance of discovering similarities between human and animal organs.
- Communication competence
- Core competencies in Science and Technology
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What is the basic structure of the human heart? What are the main functions of the heart?
- How is it compared to the pig heart? Compare using the plastinated organ.
- Why is it important to study the similarities between human heart and pig heart? How is it applied in practice?
- How does the human heart compare to the hearts of other animals?
- Are there any interesting differences in heart structure and function between species? (compare witfish, frog, reptile, bird, mammal animals)
- What is the status of clean and dirty blood in animals in comparison to humans?

STUDENTS´ ORGANIZATION

Groups of 2/4 students.

TIME

3 sessions.

PROCESS

Introduce what is comparative anatomy. Why is it important?

What are the benefits of studying animal organs as models?

Give the plastinated pig heart to the students and ask them to examine it carefully. Ask them to mention if they can see any similarities or differences with the human heart.

Ask them to split into groups and work at home to find more differences and similarities between the plastinated model and the actual human heart. Encourage them to search for information on the internet. In their research they should also focus on the importance of finding similarities between human and animal organs.

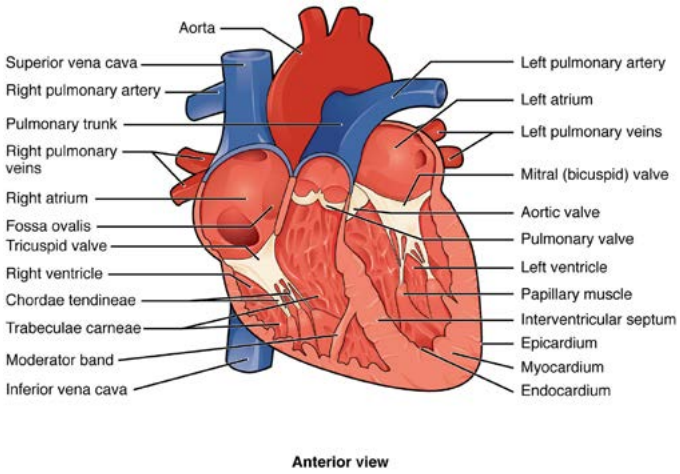
Students present their findings in class. They provide pictures of the actual human heart and they compare them with the plastinated model the have. They should focus on similarities and differences in size, shape, chambers, valves, and major blood vessels.

RESOURCES

- Plastinated heart
- Internet access for information

Video 1

Link



Anterior view

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Accuracy of information	40
Explanation of the ideas	30
Presentation	30

TECHNOLOGY

LEARNING UNIT 2: ***TOOLS FOR HEART STUDY***

INTRODUCTION

What technologies are used to study the heart?

- Discuss medical tools like EKG, echocardiography, MRI, endoscopy, and oximeters.
- Examine how technology aids in heart monitoring and diagnosis.

When delving into the anatomy of the heart within a technology-focused stream, it's great to engage students by exploring the intersection of medicine and technology. Here are some guiding questions, types of technology, and activities:

First look at general questions on Technology:

Technology and Heart Imaging:

- How do imaging technologies like MRI, CT scans, or echocardiograms help visualize the heart's anatomy?
- What are the advantages and limitations of different imaging technologies in studying the heart?

Surgical and Interventional Technology:

- What role do technologies like robotic-assisted surgery or minimally invasive procedures play in heart surgeries?
- How has technology advanced in making heart surgeries safer and more efficient?

Wearable Technology and Heart Monitoring:

Wearable technology has made significant advancements in heart monitoring, providing accessible ways to track heart health.

- What wearable devices are available for monitoring heart health, and how do they work?
- Fitness Trackers: Devices like Fitbit, Garmin, or Apple Watch include heart rate sensors that continuously monitor heart rate during activities and at rest.
- Smart clothing: Clothing with embedded sensors, such as smart shirts or bras, can monitor heart rate and other vital signs.
- Wearable ECG Monitors: Devices like KardiaMobile or AliveCor offer handheld ECG monitors that can be attached to smartphones for recording and analyzing electrocardiograms (ECGs).

• Pulse Oximeters: Finger-worn pulse oximeters measure heart rate and blood oxygen levels, often used in sports or medical settings.
• How can technology help in early detection of heart-related issues through continuous monitoring?
• How are technologies like machine learning and data analysis used in understanding heart conditions, predicting risks, or personalizing treatments?
• Design a Wearable Prototype: students to design a prototype of a wearable heart monitoring device using everyday materials, emphasizing creativity and functionality.

Introduction to Heart Endoscopy:

• Start with an overview of how endoscopy is used to study the heart's structure and function.
• Position the endoscopic camera (attached to a flexible tube) inside the model heart, aiming to navigate through its chambers.
• Observation and Analysis: Display the visuals from the endoscopic camera onto a screen for students to observe in real-time.
• Guide students through the visualisation of the heart's structures such as valves, chambers, and blood vessels as the 'endoscope' moves through the model.
• Encourage students to identify and discuss what they see as the endoscope moves through different parts of the heart. Prompt them to note the structures and discuss their functions based on their observations.
• Provide case scenarios or examples where endoscopic examinations have been crucial in diagnosing heart-related issues. Ask students to analyse and discuss these cases.
• Assign students to research a specific heart condition or disease diagnosed or studied using endoscopy and present their findings to the class.

By carrying out an endoscopic exploration of a model heart Organkit , students can engage visually and conceptually with the intricate structures of the heart, fostering a deeper understanding of how endoscopy contributes to studying cardiac anatomy and function.

TASK 1. **ENDOSCOPY**

OBJECTIVES

- Communication competence
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What is the structure of the lung? How does it look?
- What is the structure of tracheal bronchial bronchioles? How does it look?
- Is there a difference between the images of healthy and unhealthy lungs?
- What differences did you observe in the structure of the trachea and bronchi?
- What differences did you observe in the external appearance of the right and left lung?

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

2 sessions.

PROCESS

Healthy and unhealthy lung organkits are taken.

First, an endoscopy is placed inside the unhealthy lung, and the trachea, bronchi, bronchioles are examined with a camera in the screenshot. Necessary notes are taken.

The differences between healthy and unhealthy lungs are brainstormed between groups and a digital concept map is created. As a result of all these results, he/she understands what needs to be done to protect lung health. Examines the environments conducive to lung health.

RESOURCES

- Neumohealth OrganKit (healthy / unhealthy)
- Endoscopy
- Smartphone/video camera
- Assessment and Evaluation form
- Small endoscopic camera (could be a smartphone camera attached to a flexible tube)
- Small light source (LED light or flashlight)
- Display screen (computer monitor or projector)

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	20
Analysing scientific collected information	10
Using the appropriate scientific language	10
Presentation of the information	10
Appropriate use of technology	30
Timely execution of the tasks	10
Ability to achieve targeted goals	10

TASK 2. **BLOOD PRESSURE MACHINE: SPHYGMOMANOMETER**

OBJECTIVES

- Communication competence
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What is blood pressure?
- How do you measure it?
- Is there a difference in the blood pressure levels recorded by students?
- Do you know if there are any medical conditions related to it? (use a health questionnaire)

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

2/3 sessions.

PROCESS

- Introduction to what is blood pressure, its significance in heart health, and how it's measured.
- Demonstrate how to measure blood pressure using a sphygmomanometer, explaining the process step by step.
- Show how to properly position the cuff on the arm and use the stethoscope or digital monitor to take readings.
- Practice Session: Divide students into pairs or small groups and provide them with blood pressure monitors. Allow them to practise taking each other's blood pressure under supervision.
- Interpretation of Readings: once readings are taken, guide students in interpreting the numbers they've obtained.
- Explain what systolic and diastolic pressure mean and their relevance to heart health.
- Discussion on Blood Pressure Variations: Lead a discussion on factors that can influence blood pressure, such as stress, exercise, diet, and genetics.
- Encourage students to hypothesise about the impact of these factors on heart health based on blood pressure readings.
- Graphical Representation: have students graph or chart their blood pressure readings over a period to observe any patterns or changes.

This activity not only introduces students to the practical aspect of measuring blood pressure but also allows them to relate these readings to the functioning of the heart, thereby emphasising the significance of blood pressure in heart health assessment.

RESOURCES

- Blood pressure monitors (sphygmomanometers)
- Stethoscopes or digital blood pressure monitors with a display
- Diagrams or visuals explaining blood pressure readings
- Human subjects
- Manual blood pressure machine (older version)
- Sphygmomanometer
- Application on mobile phone
- Assessment and Evaluation form

Video 1

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	20
Analysing scientific collected information	10
Using the appropriate scientific language	10
Presentation of the information	10
Appropriate use of technology	30
Timely execution of the tasks	10
Ability to achieve targeted goals	10

TASK 3. **HEART MONITORING DEVICES**

Assign students to research and compare different wearable heart monitoring devices available in the market, considering features, accuracy, and usability. Collect heart rate data using wearable devices during different physical activities or stress situations, and analyse the variations observed. Students to use smartphone apps or computer software to simulate ECG readings to analyse and interpret the various patterns.

OBJECTIVES

- Understand the technology behind heart monitoring devices
- Investigate the engineering principles involved in the design and functionality of heart monitoring devices
- Connect heart anatomy with the development and use of heart monitoring technology
- Foster critical thinking and problem-solving skills
- Communication competence
- Develop core competencies in Science and Technology
- Develop digital competences

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- How do heart monitoring devices work?
- What are the different types of heart monitoring devices available?
- How can heart monitoring devices contribute to the early detection and management of cardiovascular conditions?

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

4/5 sessions.

PROCESS

Research phase: Introduction to Wearable Heart Monitors by explaining the concept of wearable heart monitoring devices, their purpose, and their significance in health monitoring.

- Assign students to research different wearable heart monitoring devices (Fitbit, Apple Watch, Garmin, etc.).
- Students should compare features like sensors, accuracy, battery life, ease of use, compatibility with smartphones, and available apps for data analysis.
- Students to present their findings in the form of a report, presentation, or comparison chart.

Collect and Analyse Heart Rate Data: Collect heart rate data using wearable devices during different activities and analyze variations.

• Provide students with wearable heart rate monitors and instruct them to wear the devices during various activities like walking, jogging, resting, or stressful situations. Students should record and log their heart rate data for each activity.

• Students will analyse the collected data and take note of variations in heart rate during different activities. Students will create graphs or charts to visually represent the changes in heart rate.

• Students will interpret the fluctuations in heart rate based on different activities and stress levels.

Extra activity : Simulating and Analyzing ECG Readings

• Students will use smartphone apps or computer software to simulate ECG readings and analyze patterns.

• Instruct students to simulate different scenarios (rest, exercise, stress) and capture ECG readings.

RESOURCES

• Plastinated organs (heart) for visual reference and demonstration.

• Internet access

• Heart rate monitoring devices (simulated or real) for practical application.

Video 1 Video 2

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Accuracy and quality of information	30
Presentation of the information	30
Level of cooperation and participation in group	20
Meeting the deadlines execution of the tasks	20

ENGINEERING

LEARNING UNIT 3: ***THE HEART AS A PUMP***

Exploring the heart as an engineering marvel involves understanding its function as a pump and how it maintains continuous blood circulation.

The heart - a tireless pumping machine

- Explore the engineering aspects of the heart's function as a pump.
- Understand the mechanics of continuous blood circulation.

Different types of pumps and heart valves

- Compare the heart to other types of pumps and discuss the role of heart valves.

TASK 1. THE HEART A TIRELESS PUMP

OBJECTIVES

- Communication competence
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What makes the heart an exceptional pumping machine?
- How does the heart maintain its tireless pumping action?
- What are the key components and structures within the heart responsible for its pumping function? Examine the chambers, valves, and muscle tissues of the heart and their roles in facilitating efficient pumping.
- Discuss the technological advancements and tools used in biomedical engineering to model, simulate, and understand the heart's pumping function.
- Explore how engineering concepts aid in diagnosing and treating heart-related conditions, such as arrhythmias or heart failure.
- Can engineering innovations replicate the heart's tireless pumping function?Discuss emerging technologies or artificial devices designed to mimic the heart's pumping action and their implications in healthcare.
- What ethical considerations are associated with engineering interventions in heart pump-related technologies?

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

2 sessions.

PROCESS

Explain the concept of the heart as a pump that continuously circulates blood throughout the body.

Create a model or simulation using a pump mechanism (e.g., a hand pump or a balloon and tubing system).

Demonstrate how the pump mimics the heart's action by continuously moving fluid (representing blood) through a circuit.

Lead a discussion on how the heart maintains its pumping action without rest, highlighting its tireless nature and its crucial role in the circulatory system.

RESOURCES

- 1 balloon
- Water
- Food colouring
- 2 plastic straws
- Food colouring
- Tape
- Scissors
- Tray

Video 1

Video 2

- Fill the jar just over half full and add a few drops of food colouring.
- Cut the neck off the balloon and stretch the rest over the opening of the jar. Save the balloon neck.
- Use the scissors to carefully poke two holes in the balloon. These should be smaller than the straw as you need them to fit tightly.
- Push each straw through a hole in the balloon.
- Place the neck from the balloon over the end of one straw and seal the end of one straw with the balloon neck and attach in place with tape. The is your valve.
- Press down on the balloon and watch what happens. Water should be forces out of the straw that isn't sealed.
- The balloon end valve stops water going back down the straw.
- Take the balloon valve off the straw. You should find that water now goes back down the straw.
- When you push down on the balloon this is like your heart contracting and squeezing the heart chambers. This pushes blood out of the heart and into arteries.

Water filter

- Stone
- Soil
- Coal
- Annual
- Bottle
- Paper cup
- Pet cup
- Pipette
- Clean water
- Dirty water
- Cotton
- Sand

Video 1

Video 2

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	20
Achieve the purpose of the experiment	40
Recycling material used	20
Presentation of the information	10
Functioning final produc	10

TASK 2. **PUMPS IN ENGINEERING**

To illustrate the heart's function as different types of pumping machines, educational activities can focus on simulating various pump mechanisms and relating them to the heart's operations.

OBJECTIVES

- Understand the function of pumps and their role in various engineering applications.
- Explore how the pumping action of the heart serves as inspiration for engineering pump designs.
- Analyze the similarities and differences between the heart's pumping mechanism and engineering pump technologies
- Communication competence
- Develop core competences in engineering
- Develop digital competences.

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- How do pumps work in engineering applications – give common examples
- How does the heart function as a pump, and what are the key components involved in its pumping action?
- How have engineering pump designs been influenced by the heart's pumping mechanism?
- Similarities and differences between heart pumps and engineering pumps

STUDENTS´ ORGANIZATION

Groups of 2 students or individually.

TIME

2-3 sessions.

PROCESS

Introduce the topic and initiate research on different types of pumps in engineering.

Analyse and compare – students present their findings, they present specific engineering applications where pumps are used.

Students present the differences and similarities between the mechanism they presented and the heart pumping mechanism.

RESOURCES

- Plastinated heart model for visual aid and demonstration purposes
- Internet access
- Visual materials or videos

Video 1 | Video 2 | Video 3 | Video 4

Video 5 | Video 6 | Video 7

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Accuracy and quality of information	30
Presentation of the information	30
Level of cooperation and participation in group	20
Meeting the deadlines execution of the tasks	20

TASK 3. **VALVES IN ENGINEERING**

OBJECTIVES

- Understand the function and importance of valves in engineering systems.
- Explore how the heart's valve system regulates blood flow and its relevance to engineering valve designs.
- Analyze the similarities and differences between the heart's valve function and engineering valve systems.
- Communication competence
- Develop core competences in engineering
- Develop digital competences.

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What is the role of valves in engineering systems – give common examples
- How does the valve system in the heart regulate blood flow and prevent backflow?
- How have engineering valve designs been inspired by the principles observed in the heart's valve system?
- What are the similarities and differences between the valve function of the heart and engineering valve systems?

STUDENTS´ ORGANIZATION

Groups of 2 students or individually.

TIME

2-3 sessions.

PROCESS

Introduce the topic and initiate research on different types of valves in engineering

Analyse and compare – students present their findings, they present specific engineering applications where valves are used

Students present the differences and similarities between the mechanism they presented and the heart's valve system

RESOURCES

- Plastinated heart model for visual aid and demonstration purposes
- Internet access
- Visual materials or videos

Video 1

Video 2

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Accuracy and quality of information	30
Presentation of the information	30
Level of cooperation and participation in group	20
Meeting the deadlines execution of the tasks	20

TASK 4. **HEART VALVES**

OBJECTIVES

- Explore how the heart's valve system regulates blood flow and its relevance to engineering valve designs.
- Analyze the similarities and differences between the heart's valve function and engineering valve systems.
- Communication competence
- Develop core competences in engineering
- Develop digital competences.

STUDENTS´ ORGANIZATION

Groups of 2 students or individually.

TIME

2-3 sessions.

PROCESS

Students use provided materials to design and build prototype artificial heart valves. Their functioning is demonstrated using water to simulate the flow of blood through the heart. Upon completion, teams demonstrate their fully functional prototypes to the rest of the class, along with a pamphlet that describes the device and how it works.

RESOURCES

- Heart organkit
- Computer with access to the internet, to research artificial heart valve ideas
- Pitcher of colored water (add a few drops of red food coloring to the water)
- Bucket (or access to a sink)
- A variety of items from the class source of supplies
- A wide selection of various disposable materials, such as pieces of rubber (of different shapes and sizes), paper clips, ping pong balls, rubber bands, plastic sheets (of varying thicknesses), wire coat hangers, metal scraps, cardboard (miscellaneous pieces), cardboard rolls (from paper towel or toilet paper rolls), dental floss, and other miscellaneous household supplies
- General building materials, such as scissors, masking tape, duct tape, hot glue guns and glue sticks,

Video 1

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	20
Achieve the purpose of the experiment	40
Recycling material used	20
Presentation of the information	10
Functioning final product	10

HEART VALVE MODEL AND BROCHURE RUBRIC

Score each from 1-5, with 1 showing no evidence to support the criteria, and 5 showing exemplary evidence supporting the criteria.

Model

Does the model function as a real heart valve would?

Are the materials used sturdy enough to support the design?

Is the model well-constructed?

Are the materials used safe?

Is a rationale provided to defend the design?

Was model developed with evidence of following the engineering design process?

Brochure

Does the brochure describe how the valve works?

Is a picture of the valve included?

Are specifications included?

Are any potential side effects of the valve discussed?

Challenge Question

Was the Unite Challenge Question addressed in the presentation?

Was accurate information about the heart, heart diseases or defects, blood pressure and heart valves included?

Rubric Total: _____

Comments:

TASK 5. **DESIGN A BLOOD SAMPLING DEVICE**

OBJECTIVES

- Understand the importance of blood sampling in cardiovascular health.
- Find the engineering principles behind blood sampling device
- Design a blood sampling device

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- Why is blood sampling important?
- How is it related to cardiovascular health?
- What are the main engineering principles in blood sampling devices?
- How can blood sampling devices be improved in the future?

STUDENTS´ ORGANIZATION

Groups of 2-4.

TIME

3 sessions.

PROCESS

Introduce the topic and discuss how important is blood sampling in health in general and then more specific to cardiovascular health. Use the plastinated organ for demonstration. Discuss about blood sampling devices. Focus on the main engineering aspects. Discuss the main principles and technology used.

Ask students to design a blood sampling device. It needs to be safe, accurate and easy to use. They need to create a prototype.

Students will present their blood sampling device to the class. They will explain the main principles. Has the use of a plastinated heart helped them to better understand the importance of blood sampling to the cardiovascular system?

RESOURCES

- Plastinated heart model for visual aid and demonstration purposes
- Internet access
- Engineering tools such as rulers, callipers, plastic, tubing, syringes etc.

Video 1

Video 2

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Creativity and functionality	40
Clarity and safety of the design	20
Understanding of engineering principles	30
Presentation	10

ARTS

LEARNING UNIT 4: ***THE HEART IN ART AND CULTURE***

INTRODUCTION

How has the heart and emotions been portrayed in art and literature?

- Explore artistic representations and cultural symbolism of the heart.
- Analyze its significance in storytelling, poetry, and visual arts.

Art Analysis: Expressionist Paintings

Select famous expressionist paintings from artists like Edvard Munch, Egon Schiele, or Wassily Kandinsky.

Discuss the emotional content and symbolism in the paintings.

Encourage students to analyze the use of color, brushwork, and composition to convey emotions.

The heart is used to represent a wide range of emotions, not just love. It can symbolize joy, sorrow, anger, and more.

Example: Edvard Munch's painting "The Scream" depicts a figure with a distorted face and a heart-shaped head, conveying a sense of existential angst and emotional turmoil.

Link

Symbol of Love and Passion:

In art and literature, the heart is often associated with love, desire, and passion. It is a universal symbol of affection and romance.

Example: In William Shakespeare's "Romeo and Juliet," the love between the two young protagonists is described in passionate terms, and the heart is frequently mentioned as a symbol of their love.

The heart as a metaphor/ Heart as a Symbol:

Discuss the heart as a universal symbol of emotions and love.

Encourage students to create art pieces that feature hearts as the central motif, exploring different emotions and contexts.

The heart is often used as a metaphor for life, vitality, and the core of a person's being.

The heart, when stated as a metaphor does not only represent the feeling of love but represents various emotional states and conditions. Students to find and analyse the following heart metaphors:

1. Heart of stone:

To have a heart of stone means the person does not show any sympathy, conscience or pity.

Example: Def Leppard's song "When Love and Hate Collide" has a chorus that goes:

"Without you – one night alone
Is like a year without you baby
do you have a heart of stone?
Without you – can't stop the hurt inside
when love and hate collide."

The heart of stone metaphor used in this song equates to despair and sadness as the person is constantly being ignored by his loved one.

2. Heart of a lion:

Having a heart of a lion means you are brave and courageous, similar to a lion.

Sentence example: My father has a heart of a lion because he always protects me from strangers and bullies.Heart of a lion is a good analogy for someone who is brave and guards the safety of other people, willing to risk his or her life for the greater good. In this case, parents place themselves in danger just to protect their children. Like how lions protect their pride, parents protect their children not of sheer compliance as parents, but out of unconditional love.

3. Heart of gold

Having a heart of gold means you are a very kind person.

Here are examples of quotes from authors that use this metaphor:

"I'd rather have a heart of gold
Than all the treasure of the world."

Ana Claudia Antunes, Memoirs of An Amazon "It's that heart of gold, and stardust shine that makes you beautiful."

R.M. Broderick The said quotes simply mean that no treasure in this world can ever match or beat the value of having a heart of gold.

4. Heart and soul

The heart and soul metaphor means that you do things with a lot of energy and enthusiasm.

The caregiver worked with heart and soul despite having a exhausting and draining job because she needs to make a living for her family.Heart and soul means having to give an extra effort but with the right mindset and attitude. In this example, we all know how tiring a caregiver's job can be, but work should be done with heart and soul because her end goal is to give a great life for her family.

5. Let your heart rule your head

Letting your heart rule your heart means that you make decisions based on feelings and emotions. Another alternative for this metaphor is heart over mind. Example: 80's hit maker Jennifer Rush (The Power of Love) has a song entitled Heart Over Mind. The chorus of the song goes:

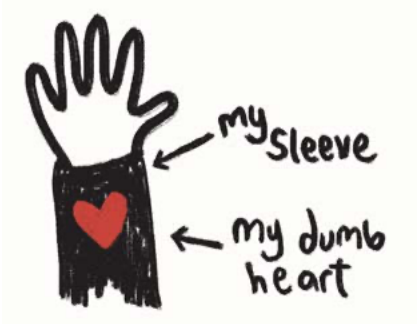
"Look over your shoulder then leave it behind
Put all the heartbreak away,
We'll start all over one step at a time
Don't let the past take my place
It's heart over mind, heart over mind"

The song talks about one person in the relationship having inhibitions and reservations in continuing the relationship, but the partner doesn't want the relationship to end and encourages the other half to let the heart make all the decisions.

6. Pour out your heart to somebody

When you pour out your heart to somebody, you tell them all your problems, confessions, interests, feelings, and other things you are not comfortable sharing with other people.

7. Wear your heart on your sleeve



Link

8. Set your heart on something

To set your heart on something means you want something very much.

9. Speak from the heart

To speak from the heart is to say something that is sincere and honest.

10. Break one's heart

Breaking one's heart means you make someone feel very unhappy and depressed.

Freepik

11. Win somebody's heart

On the other hand, if you win somebody's heart, you receive love from the person you gave love to in the first place.

12 Have a big heart

Having a big heart means you are a kind and generous person.

13. The heart of the city

The heart of the city simply means the capital or center of the city. It could be a landmark, a business district, or any other public place.

Emotion-Focused Self-Portraits:

Ask students to create self-portraits that express a specific emotion. They can choose from a range of emotions like joy, sadness, anger, or love.

Encourage them to use various art mediums (e.g., painting, drawing, or collage) to convey their chosen emotion.

The Anatomy of Emotion:

Explore the concept of emotion and its physical manifestations.

Students can create detailed anatomical drawings or sculptures that depict how they perceive emotions within the human body.

Literary Art Pairing:

Pair works of literature or poetry with visual art.

Students can create artworks inspired by the emotions and themes in the text. For example, reading a poem about love and creating art that interprets the poem's emotional content.

Music and Visual Art Fusion:

Play a piece of music and have students create visual artworks (paintings, drawings, or sculptures) that represent the emotions or scenes the music invokes.

Emotion-Based Photography:

Teach students about expressive photography and encourage them to capture moments that evoke strong emotions.

Discuss composition, lighting, and color choices that can convey feelings in photography.

These activities not only allow students to explore emotions and the concept of the heart through art but also provide opportunities for self-expression and personal growth. Encouraging creative exploration of these themes can be a powerful means of connecting with and understanding their own emotions.

Create heart themed artwork or poetry:

• Encourage students to express their understanding of the heart and emotions through art or creative writing.

• Discuss the emotional and symbolic aspects of the heart in their work.

Music and emotions' impact on the heart:

• Explore the connection between music, emotions, and the heart.

• Consider how music can influence heart rate and feelings.

TASK 1. **EMOTIONS & THEIR VISUALISATIONS**

OBJECTIVES

- Communication competence
- Develop Artistic skills
- Core competencies in Science and Technology
- Reach target achievements
- Increase academic achievement
- Learning to learn competence
- Digital competence

STUDENTS´ ORGANIZATION

Groups of 4 students.

TIME

2 sessions.

PROCESS

Students are asked how you are feeling, 5 options are given to describe the emotional state.

Students are then divided into groups according to their emotional state and questionnaire given.

What does life mean to you? Represent this in a picture drawing of your choice.

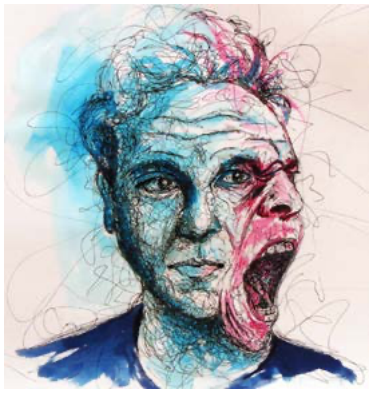
The results are compared.

Different pictures made to a common concept are analysed in relation to the feelings the students expressed they felt.

the paint colors used while painting are analysed and compared according to the emotional state of the students.

RESOURCES

- Pen
- Paper
- Paint
- Brushes
- Canvas
- Any other art material to enhance creativity



ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Conveying scientifically correct information	20
Use of art for the intended purpose	30
Reporting of the resources used & its reliability	30
Timely execution of the tasks	10
Ability to achieve targeted goals	10

TASK 2. **ANATOMY INSPIRED ART**

OBJECTIVES

- Explore the connection between anatomy, specifically the heart, and artistic expression.
- Encourage students to create artwork inspired by the structure, function, and symbolism of the heart.
- Use plastinated heart models as visual references and inspiration for the artwork.

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- How can the anatomy of the heart inspire artistic creativity?
- What are the symbolisms connected with the heart and how it is depicted in arts?

STUDENTS´ ORGANIZATION

Groups of 2 students or individually.

TIME

5-6 sessions.

PROCESS

Introduce the concept of anatomy-inspired art.

Provide students with information about the structure and function of the heart. Use the plastinated organ for demonstration.

Give examples of artists who have used the heart in their artwork.

Students do research on different art techniques and styles that can be used to depict the heart.

Students observe the plastinated heart and then create artwork such as drawing, painting, sculpture, or mixed media, to depict it. The need to incorporate elements of the heart's anatomy, symbolism, and personal expression into their artistic creations.

Students present and discuss their creations.

RESOURCES

- Plastinated heart model
- Art supplies (e.g., paper, canvas, paints, clay, sculpting tools, mixed media materials).

Video 1

Blog

ASSESSMENT AND EVALUATION

Students will be assessed based on the quality of their artwork.

Peer assessment can also be done.

MATHEMATICS

LEARNING UNIT 5: ***QUANTIFYING HEART DATA***

1. How is heart health quantified and measured?

- Discuss key metrics like heart rate, blood pressure, and cholesterol levels.
- Explore the role of statistics in cardiac research and diagnosis.

2. Collect and analyze heart rate data

- Conduct experiments to collect and analyze heart rate data under different emotional conditions.
- Discuss how maths helps interpret heart-related data.

TASK 1. HEARTBEAT AND MATHEMATICAL PATTERNS

OBJECTIVES

- Understand the concept of the heartbeat and its relationship to mathematical patterns.
- Explore mathematical topics such as counting, measurement.
- Analyze and interpret data related to heartbeat measurements and identify mathematical patterns.

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- How does the heartbeat relate to mathematical concepts and patterns?
- What mathematical patterns can we identify from heartbeat measurements?

STUDENTS´ ORGANIZATION

Individually.

TIME

Multiple sessions.

PROCESS

Discuss the concept of the heartbeat and why it is important in measuring and monitoring health. Discuss the mathematical aspects of heartbeats, such as counting pulses and measuring heart rate.

Students measure their own heartbeats at different times, such as resting, after exercise, or during different activities. They record their data. Instruct students to organize and analyze the data using mathematical tools and techniques.

Students identify patterns, such as trends, variations, or relationships, within the collected heartbeat data and present them to the class.

RESOURCES

- Heart rate monitors or devices for students to measure their heartbeats (if available).
- Sheets or software to record data.
- Mathematical tools and resources for analyzing data (e.g., calculators, spreadsheets etc.)

Video 1 Video 2

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Accuracy of measurements	30
Quality of analysis of data	60
Presentation of the information	10

TASK 2. **PROBABILITY OF HEART DISEASE**

OBJECTIVES

- Understand the concept of probabilities.
- Apply mathematical probability formulas to evaluate heart disease risk based on lifestyle (diet, not exercising, smoking, obesity etc.).
- Make suggestions about healthy lifestyle based on probability results.
- Use plastinated heart to present which part of the heart is more likely to be affected by specific lifestyle choices (e.g. diet, not exercising, smoking)

MAIN QUESTIONS TO BE ANSWERED BY STUDENTS MAKING THIS PROJECT

- What are the main risks that can lead to heart disease?
- How can we use probability to evaluate if someone is at risk of heart disease? What factors are more important than others?
- How can we use these formulas to develop a healthier lifestyle?

STUDENTS´ ORGANIZATION

Individually or in small groups.

TIME

2 sessions.

PROCESS

Present students the basic lifestyle choices that can lead to heart disease. What are more important than others?

Ask students to collect their own data based on their research.

Then according to their research, they should develop a formula about the probability of someone developing a heart in a specific time frame (e.g. 10 years) if he does not follow basic healthy lifestyle (e.g. poor diet, not exercising, smoking).

Students should work in groups of no more than two and in the end present their findings and their formula. They need to justify how they developed the formula, why they consider some factors more important than others and how it affects their formula. They should use the plastinated heart to present which part each habit affects and how it affects their formula.

RESOURCES

- Plastinated heart
- Internet access for information

ASSESSMENT AND EVALUATION

Student assessment scale	**(100)**
Accuracy of information	40
Justification of the formula	40
Presentation	20

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