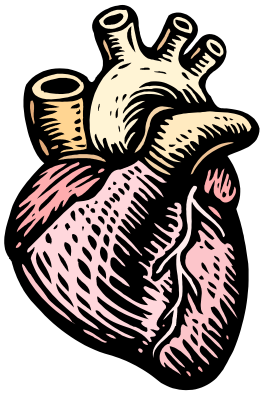
Learning situation:
The cardiac pump

(Introduced by the analysis of technical objects)



CONTEXT:
Analysis of the water pistol

YOUR MANDATE consists in studying the function of a pump in order to create a pumping system having similarities to that of the heart.

BROAD AREA OF LEARNING:

Health and well-being

CONCEPTS RELATED TO THIS LEARNING SITUATION:

LIVING WORLD
Circulatory system (types of blood vessels)
Functions of blood constituents (plasma, formed elements)
Compatibility of blood types

MATERIAL WORLD
Compressible and incompressible fluids
Pressure
Pressure/volume relationship

TECHNOLOGICAL WORLD
Exploded view
Cuts and sections
Standards of representation
Typical links of mechanical parts
Functions, components and use of motion transmission systems
Functions, components and use of motion transformation systems

POSSIBLE CULTURAL RESOURCES

Artificial hearts
Pumping systems

Working document

SEQUENCE OF LEARNING in the student's booklet:

1. Study of the workings of a water pistol;

After the study, it would be opportune to pool the scientific and technological principles involved so that each student well understands the workings of the water pistol's pump.

2. Fabrication of a pump with an eye on designing an activation mechanism to make it work;

Presentation and explanation of drawings and range of manufacturing as well as the frame on which the manufactured pump will be built.

Supply the students with the materials necessary to manufacture the pump.

Once the pump is built, adjustments in terms of a proper seal are to be expected. Depending on the assemblies the students create, it is possible that there will be leaks from the valves.

3. Presentation of specifications;

Explain the specifications included in the student booklet. Do a first collective plenary session in order to outline well the problem to be resolved.

4. Study of mechanisms of transmission and transformation of motion.

- *Use a panoply of objects containing mechanisms pertinent to the task;*
- *Use existing demonstrators available at science and technology material retailers;*
- *With the help of the diagrams on the sheet entitled "MECHANISMS OF TRANSMISSION AND TRANSFORMATION OF MOTION", proceed with discussions in small groups.*

5. Creation of the design steps as outlined in the student booklet. *Students register the required information. This part is essential in order to evaluate competency 1. We suggest two variations depending on the type of student and available time.*

Variation 1: *Go through the stages of total design based only on the specifications supplied. Introduce a part of analysis of objects or demonstrators that may prove useful to the realization of the pumping mechanism.*

If certain students are not able to come up with a solution, it is suggested you supply them with the solutions diagrams.

Variation 2: *By adapting the specifications, it is possible to present the principles diagrams of the different possibilities of mechanism solutions in order for the students to develop a construction study based on the diagrams supplied. The analysis of the proposed solutions will bring the students to create construction solutions (links, guides, support…) in terms of the materials available in the lab. He then builds his mechanism.*

6. Pooling of teams' mechanisms

7. Analogy between the components of the cardiac apparatus, the water pistol and the mechanical pumping system created by the student.

The student continues his work in his booklet.
Different documents may be suggested to the students in order for them to understand the heart's function and the transportation of blood (diagrams, reference books, demonstrators, animations…)

8. A return to the task may be made by pursuing a more theoretical approach towards blood components and their function, components of the circulatory apparatus and blood type compatibility.

This task may bring forth the following questions: "What are the causes and possible effects of a deficient cardiac pump? How can I change my lifestyle to ensure that my cardiac system works well?"

Analogy of the heart's pathologies in relation to the function of the cardiac pump.