Working document

OVERVIEW OF THE « Gaussbusters » LES

NOTE: This activity was designed within the framework of teacher training sessions. It may require adaptation before being used with students.

Target audience:	2nd year of the 2nd cycle of secondary AST and EST programs
Team work:	Individual and in teams of two
Class time required:	8 - 75 minute periods

Aims:

The study of the concepts related to printed circuits and electronic components are in the programs for applied science and technology and for science and technology of the environment. This learning situation leads the student to become familiar with these concepts in a practical way, while remaining feasible in a workshop and laboratory environment.

Pedagogical intentions:

- Allow the student to familiarise him/herself with the operating principles of electronic components targeted in the AST program (recognise the components, use them in simple circuits).
- Allow the student to become comfortable with the fabrication technique for printed circuits, using resin photosensitive to ultraviolet radiation, and to techniques related to building electronic circuits (assembly, soldering, connections).
- Allow the student to become familiar with the concept of electromagnetic fields.
- Allow the student to experience a design process requiring him/her to build a prototype that promotes the use of machine tools, tools and various materials.

Educational intentions:

- Face the student with an attainable challenge in order to create interest and to motivate him/her.
- Lead the student to form an opinion using contradictory information relating to the same subject. (S)he must judge the validity of the available information and of its source.

Targeted disciplinary competencies:

C-1 Look for answers or solutions to problems of a scientific or technological order.
C-3 Communicate using the languages used in science and technology

The student will have to take into account a specifications booklet relating to the design of a gaussmeter housing for which (s)he will already have made the printed circuit. (S)he will have to plan the steps of the process, carry out the prototype, test it and respect drawing conventions to represent his/her solution.
(S)he will become familiar with the symbols used to represent electronic components.

Broad areas of learning	*Career planning and entrepreneurship* Focus of development: self-knowledge and awareness of his/her potential and how to fulfill it (recognition of his/her talents, strengths, interests and personal and career aspirations) *Environmental awareness and consumer rights and responsibilities* • Focuses of development: knowledge of the environment (understanding of certain characteristics of the human environment, awareness of the interdependence between the environment and humans); responsible use of goods and services (concern about the impact of science and technology)
Required concepts	**Material world:** Electricity • Electrical load • Static electricity • Ohm's Law • Electrical circuits • Electrical field (EST) Electromagnetism • Forces of attraction and repulsion • Magnetic field of a solenoid • Electromagnetic induction **Technological world:** Language of lines • Multi view orthogonal projections (set drawing) • Standards and representations (sketches, symbols) • Scales Electrical engineering • Supply function • Conduction, insulation and protection functions (codification resistance and printed circuit) • Command function (magnetic and push button switches) • Transformation of energy function (electromagnetic energy into mechanical light and sound energy) • Other functions (condenser, diode, transistors, relays)
Cultural references	• Presence of electrical and electronic devices in our lives • Presence of electrical transmission wires in proximity to inhabited areas • History of electricity • Speed of discoveries related to electronics

Processes	The *design process* is at the heart of this LES. The guided *experimental process* is also used throughout the integrated learning activities. Though it is not an integral part of the student booklet presented here, the *opinion building process* could easily be integrated into the LES through a complex task relating to the effects of electromagnetic fields on humans. This avenue would be advisable in the framework of an EST class.
Strategies, attitudes and techniques	**Strategies:** • Generalise based on several specific cases that are structurally similar • Explore various solutions trails • Determine the constraints and the elements vital to the resolution of a problem. **Attitudes:** • Sense of craftsmanship • Concern for safety and security **Techniques:** *Technology* Graphical language • Use of scales Fabrication • Safe use of machines and tools (band saw, drill, sander, hammer, screwdriver, pliers, etc.) • Tooling (sawing, drilling, filing, stripping and splices, tin and lead soldering etc.) • Verification and control • Assembling and disassembling *Science* Manipulations • Safe use of laboratory equipment *Techniques common to science and technology* • Use of instruments of measurement

Global context:

The student must become familiar with the basics of electronics in order to make a device capable of detecting electromagnetic fields. To succeed, (s)he will use his/her scientific and technological knowledge as well as his/her qualities as a designer, in order to ensure easy data collection by the user.

The student will be guided through a series of directed laboratories that will ensure the acquisition of the necessary knowledge to carry out the design process.