Technology

3 ESO

This book is dedicated to you

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Section 1 Projects and drawing

1 THE TECHNOLOGICAL PROCESS 4
1.1 Analysis of an object 5
1.2 Documents for a project 6
1.3 Recycling 8
1.4 The working environment: health and safety 9
1.5 Computer tools to plan, develop and present the project 9
1.6 Sales 10

2 PERSPECTIVE IN DRAWINGS 12
2.1 First angle projection 13
2.2 Oblique projection 14
2.3 Axonometric projection 15
2.4 Two point perspective 16
2.5 Single point perspective 17
2.6 Scale 18
2.7 Dimensions 19
2.8 Measuring 20

Section 2 Materials

3 PLASTICS 24
3.1 Polymers 25
3.2 Types of plastics 27
3.3 Additives 31
3.4 The plastic coding system 31
3.5 Tools and techniques to work with plastics 32

4 CONSTRUCTION MATERIALS 36
4.1 Stone 37
4.2 Cement 38
4.3 Mortar 39
4.4 Concrete 40
4.5 Plaster 41
4.6 Ceramics 42

Section 3 Electronics and electricity

5 ELECTRONICS 56
5.1 Fixed value resistors 56
5.2 Variable value resistors 48
5.3 Capacitors 49
5.4 What are semiconductors? 49
5.5 Diodes 50
5.6 Transistors 52

6 ELECTRICITY 56
6.1 Electrical magnitudes 56
6.2 Measuring with a multimeter 58
6.3 Electric symbols 59
6.4 Electric circuits 60
6.5 Types of circuit 61
6.6 Alternating Current (AC) (~) 63
6.7 Direct Current (DC) (⎓) 64
6.8 Basic electric machines 65

Section 4 Energy and society

7 ENERGY AND ITS TRANSFORMATIONS 70
7.1 Energy 71
7.2 Power 71
7.3 The production of electricity 72
7.4 The transportation and distribution of electricity 76
7.5 The transportation and distribution of fossil fuels 77
7.6 Energy efficiency 78

8 TECHNOLOGY AND SOCIETY 80
8.1 Pollution 81
8.2 The depletion of resources 82
8.3 Correcting technologies 83
8.4 Sustainable development 84

Section 5 Computing

9 HARDWARE AND SOFTWARE 86
9.1 Hardware 86
9.2 CPU 87
9.3 Storage 88
9.4 Expansion cards 91
9.5 Peripherals 92
9.6 Sharing resources on a local network 93
9.7 Software 94
9.8 Computer languages 95
9.9 Basic system maintenance 96

10 APPLICATIONS 98
10.1 Installing new applications 98
10.2 Vector drawing 99
10.3 Raster graphics 100
10.4 Databases 102
10.5 Spreadsheets 104

11 CONTROL AND ROBOTICS 108
11.1 Parts of a robot 109
11.2 Types of robots 113
11.3 Uses and applications 113
11.4 Regulation in control systems 114
11.5 History 115
11.6 Future 115

12 COMMUNICATION TECHNOLOGY 118
12.1 Wired and wireless communication 118
12.2 Radio and television 120
12.3 Radio-electric spectrum 120
12.4 Satellites 121
12.5 Telephony 121
12.6 Web pages 122

Chapter 1

THE TECHNOLOGICAL PROCESS

We all use technology every day, when we write with a pen, speak on the phone, etc.

Technology is more than a set of tools and techniques for making an object. It's also about organising projects and it is linked to business knowledge.

Members of a team work together to achieve the best team result. A team member's responsibility is to contribute to the team, although individual progress is important too.

When you work in the workshop, you can organise the team so that there is a student responsible for each of the following tasks:

- Tools: the student responsible for tools checks that all the tools are in the right place at the beginning and again at the end of the lesson.
- Materials: the person responsible for materials collects the project and the materials from the store. At the end of the class she/he puts everything back in the right place.
  It's useful to write the name of the team on the project. For example: Red team, 3rd ESO – A.
- Health and safety: the student responsible for health and safety ensures that the team follows the teacher's safety guidelines, and that the team cleans the work area before the end of each class.
- Secretary: the secretary supervises all the documents. He/she checks that they are organized and ready to show to the teacher.

1 What is the responsibility of a team member?

2 Could you organise the team in a different way? How?

1.1 Analysis of an object

Shape

We can define and classify an object by its shape: square, long…

We define the shape in a drawing.

Defining the shape is important for designers and manufacturers/builders. For example, the builder of a bridge builds the bridge using the shape which is defined in the drawing.

Functional analysis

We can define and classify objects by their function.

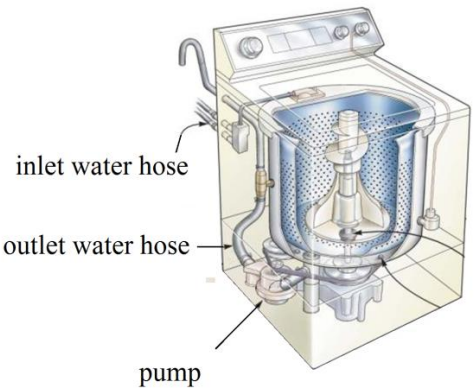
For example, the different functions of a washing machine include washing, rinsing and spinning.

Defining the function of a product and how to use it is very important for customers. For example, when you buy a washing machine you want to know what the different buttons are and what functions they have.

An instruction manual tells the user how to use the object and how to operate its different functions.

Technical analysis

We can analyse various things in technical analysis: the structural strength of an object (if it will break during use), its energy efficiency, safety issues, the dynamics of the object, the different parts that it is made of, how it works, etc.

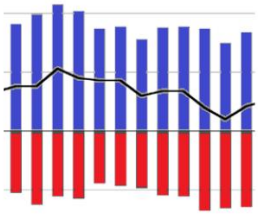


Economic analysis

We can also analyse an object from an economic point of view: its purchase value, the cost of using it, the benefit that it produces.

For example, when you buy a washing machine, you may consider:

- Price
- How many years it will last.
- How many euros worth of electricity and water it will consume.
- Cost of repairs.



There are other aspects that you need to consider as part of the economic analysis which are quite hard to evaluate.

For example, if the driver's seat of a bus is comfortable, the driver is happier and works better.

So comfort is also part of the economic analysis, although it's difficult to calculate the productivity of comfort.

3 Working in pairs, choose an object that you like and do the four types of analysis.

1.2 Documents for a project

Each step of a project has its own documents.

It's best to create the documents using a computer. Computer documents are clearer, tidier, easy to modify, and easy to share.

Robot specification:

- Assemble two sits per minute.
- Occupy less than 20 m^2.
- Consume less than 0.7 KW/h of energy per sit.
- Uptime better than 99.8%.
- Contract includes 6 years maintenance from the supplier.

Sits are 1.8 m wide and weigh 16 Kg.

Each sit is to be bolted with 4 bolts.

1 – Specification

The specification is the document in which the client describes the required product or service.

For example, let's imagine that a car manufacturer requires a robot to assemble seats in the cars.

The engineer from the car manufacturer writes a specification describing the seats and the requirements: the size and shape of the seats, the number of seats to be assembled per minute, etc.

The specification is part of the contract between the supplier and the client.

The client sends the specification with a request for a quote to several potential suppliers.

Robot proposal:

- Robotic arm with manipulator adapted to the shape and size of the sits.
- Electric 12 KW robot with noise levels below 57 db.
- Consumption: 0.64 KWh per sit.
- Occupies 17.5 m^2.
- Uptime 99.8% with 1 hour of night time maintenance plus 2 hours of weekly daytime maintenance.
- Price: 1,600,000 euros + 70,000 euros per year of maintenance.

2 – Quotes and proposals

Each potential supplier returns a quote or a proposal to the client.

The client then reads the quotes or proposals from the different suppliers and selects the best one, based on cost, quality and any other consideration.

Quote: if the supplier simply quotes a price for the specification, with no further details, then we call it a quote.

Proposal: if the supplier explains how the project would be done, or even suggests alternatives and/or changes to the specification (in addition to the quote), then we call it a proposal.

3 – Plan

In the plan, the team describes the tasks and the required resources.

Tasks must be described in detail, breaking them down into small parts.

Resources are:

- Tools (saw, power source, etc.).
- Materials (wires, diodes, connectors, etc).
- Human resources (who will do the work).
- Time (the total working hours from start to finish).

4 – Design / drawing

The design must be:

- Functional: the product must do what the customer needs. For example, if you design a pencil sharpener, it must sharpen pencils.
- Economical.
- Durable: it's better if it doesn't break.
- Environmentally friendly.

"Economical" and "durable" are combined concepts. If a 20-cent pencil sharpener lasts 3 years, then it's more economical than a 10-cent pencil sharpener which only lasts 1 year … unless you only need it for 1 year!

Draw in first angle projection to define the shape and dimensions of the object and its parts.

Indicate the materials for the different parts.

Some drawings, called "assembly drawings", indicate the relative position of the different parts for assembly, and the order in which they are assembled.

A good example of assembly drawings are those that come with flat-pack furniture which you buy in a box and assemble yourself at home.

Some drawings indicate the sequence in which manufacturing operations must be performed. For example: first drill holes, then bend along edge, then...

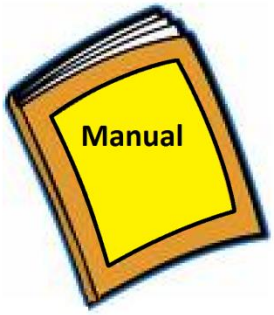
5 – Bibliography

The bibliography indicates where you found your information.

It's important to give the source/s of your information because some sources are more reliable than others.

6 – Manual

Write a manual with step-by-step instructions worded mainly for non-experts.



If the product could be dangerous, you must warn the user.

The users may need to change some parts after some time. For example, cars have a maintenance manual that tells the user when to change the engine oil, etc.

7 – Receipt

It's unlikely that you'll sell what you construct in the workshop, but if you do, you'll need some documents.

The seller gives the buyer a receipt when the buyer pays. The receipt describes the product and indicates the price.

4 Working in pairs, imagine a project and write all the documents for that project.

1.3 Recycling

First of all it's best not to create unnecessary waste (reduce your consumption!).

Reuse and recycling have always existed. Traditionally, reused or recycled materials were those that had some value.

Nowadays, by recycling or reusing materials, we reduce our impact on the environment as well as saving money.

Recycling has a lot of environmental advantages:

- it reduces energy consumption
- it reduces the demand for natural resources
- it reduces the need for landfill sites

Recycling symbols

Depending on the material that we use to make an object, some or all of it is recyclable.

Writing a description of how to recycle the object in the manual is not the best option because manuals often get lost before the object arrives at the recycling point.

To help recycle the object, the best thing is to make marks on the product itself.

möbious loop

The internationally-recognized symbol for recycling is the icon of three chasing arrows, known as the "möbious loop". We use this symbol when the object is recyclable, but it has no specific meaning.

The "möbious loop" can be misleading. Sometimes the material is technically recyclable, but in practice there isn't a recycling service so the consumer has to put it in the general bin.

There are specific recycling symbols for some common materials, such as aluminium, steel, glass, and different types of plastics.

aluminium

steel

glass

1.4 The working environment: health and safety

When you go to the workshop your teacher will give you instructions which you must follow.

Use tools carefully. Use power tools only with your teacher's permission. Be tidy.

The "health and safety" instructions ensure a safe working environment for workers, customers, suppliers, nearby communities, and other members of the public who may be affected.

Health and safety is related to many areas: medicine, psychology, ergonomics, etc.

To evaluate the working environment, we identify hazards and risks.

A hazard is something that can be harmful. The severity of a hazard is how harmful it can be.

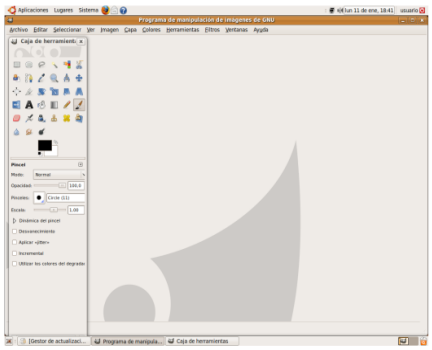
A risk is a combination of the probability that something will happen and how harmful it would be if it happens.

We make a table to evaluate risks. We calculate the risk by giving a value to the severity of the hazard and multiply it by the probabilities of it happening.

probability \ severity	3	2	1
4	12	8	4
3	9	6	3
2	6	4	2
1	3	2	1

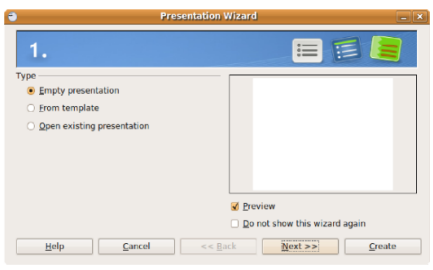
1.5 Computer tools to plan, develop and present the project

The computer tools that we use for a project depend on what we want to do.



For example, to make technical drawings, use a "vector drawing" application, such as AutoCAD from Autodesk or Draw from OpenOffice. To write reports use a text editor, such as OpenOffice Writer or Microsoft Word.

To present the project in public, use a presentation application such as Impress from Open Office or PowerPoint from Microsoft.



There are specific "project applications" such as Replicon, Project (Microsoft), or SmartDraw, which are designed to organise the planning of big professional projects.

Specific project applications relate tasks and resources in a timetable. If, for example, a task is delayed, the tasks that follow are automatically delayed, or if a resource is being used more than planned, the software gives a warning.

5 Think of 5 possible risks and evaluate them using a "severity/probability" table.

1.6 Sales

The "rule of the four p's"

The "rule of the four p's" is the core of marketing theory. It says that "if *the right product is in the right place at the right price, it can be sold*". Promotion is optional; it helps to increase sales.

- Product. The product must be something that a consumer wants to buy.
- Place. The product must be easy to find.
- Price. It must not be higher than what the customer is prepared to pay (can and wants to pay).
- Promotion is a set of techniques to raise customer awareness of the existence of the product and increase his/her willingness to buy it.

Timing is also important. It's difficult to sell ice cream in winter!

Fixed and variable costs

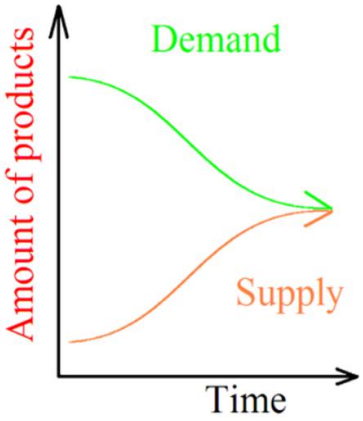
Total costs are the sum of fixed and variable costs.

Fixed costs are those that don't depend on the amount of products produced.

For example, in a car factory, the salaries of the employees, the price of the tools, etc.

Variable costs are those that depend on the amount of products produced.

For example, in a car factory, the materials to make the cars, the electricity to operate the machines, etc.



Law of supply and demand

In general, suppliers produce a product when customers demand it.

- If demand is higher than supply, the price rises.
- If demand is lower than supply, the price drops.

In the long term supply equals demand, because:

- If the prices rise, the demand will decrease and/or the supply will increase.
- If the prices drop, the demand will increase and/or the supply will decrease.

Flexible/Rigid products

A product has "flexible demand" if its demand changes a lot with small changes in price. They are products that we don't need or that have a substitute.

A product has "rigid demand" if its demand doesn't change a lot with changes in price. They are products that we need. Bread, for example: we buy the same amount of bread regardless of price.

Products can also have "flexible supply" or "rigid supply" if it's easy or difficult to increase or reduce the supply.

6 To make chairs we buy wood, glue and a saw. Which has a fixed cost? Why?

7 Demand for washing machines is "flexible" or "rigid"? Why?

Activities

1 What is team work?

2 If there were four people working in a team, how could they divide the tasks?

3 Do a functional analysis of your washing machine at home.

4 Search for information and describe the different parts (technical analysis) of a washing machine.

5 When you buy a pair of shoes, what economic aspects may you consider?

6 Write a specification for a pencil case.

7 When you plan a project, what types of resources may you consider?

8 What concepts must be considered in the design step?

9 Look at these symbols. What do they mean?

10 Look at the products that you have at home. Make a list of ten of them and their recycling symbol: bottles, plastic bags…

11 In health and safety:

a) What is a hazard?
b) What is a risk?

12 Make a table classifying various risks by probability and severity.

13 List seven computer tools helpful to plan, develop or present projects.A

14 In marketing:

a) What is the "rule of the four p's"?
b) What does each "p" mean?
c) What else is important?

15 The monthly costs of a garage are: rent 4,000 €, 30 € per tyre, salaries 8,000 €, 12 € per spark plug, 300 € per exhaust, 24 € per oil filter.

The table shows selling prices, months and number of items sold.

	January	February	March	April	May	June
60 € / tyre	50	48	42	46	26	22
20 € / spark plug	12	16	16	8	8	12
500 € / exhaust	36	33	35	30	38	29
70 € / oil filter	54	55	60	64	61	58

a) Which costs are fixed and which are variable?

b) Calculate the variable, fixed and total costs for each month.

c) What is the financial gain or loss for each month?

16 Following the law of supply and demand:

a) When do prices rise?
b) Why does demand tend to equal supply?

17 Bread, electricity, guitars, petrol, chocolates. Of these products:

a) Which have a "flexible" demand? Why?
b) Which have a "rigid" demand? Why?
c) Which have a "flexible" supply? Why?
d) Which have a "rigid" supply? Why?