

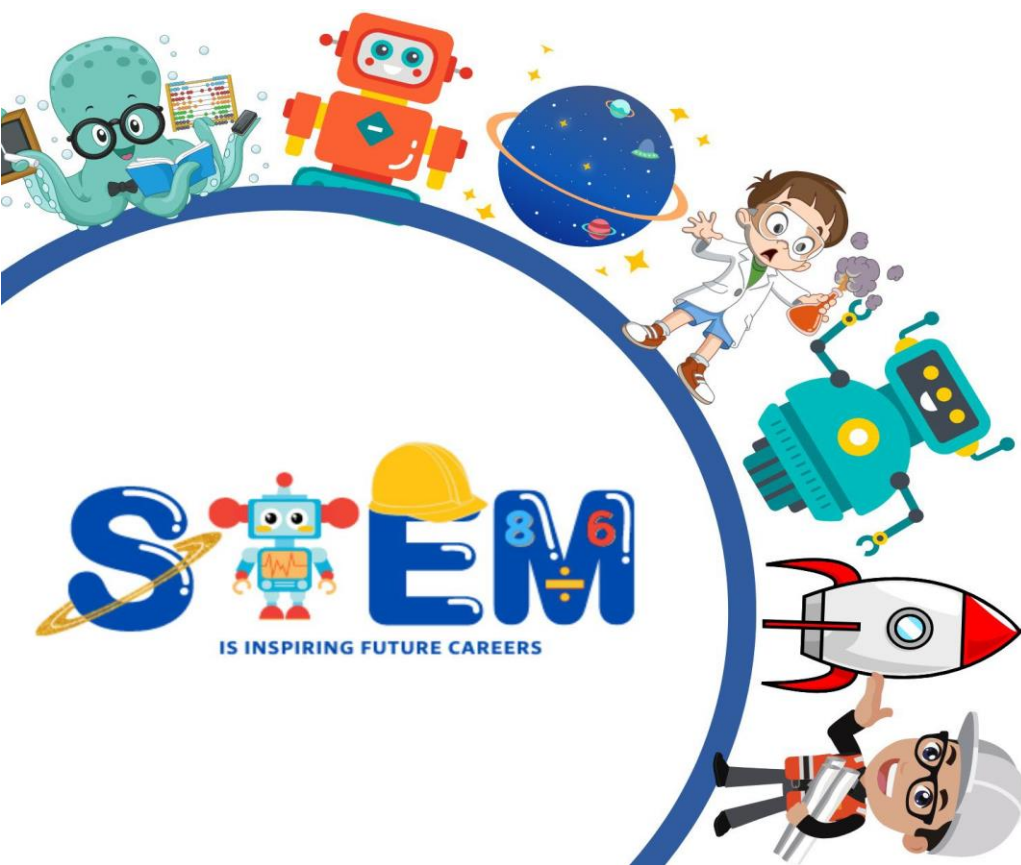
STEM IS INSPIRING FUTURE CAREERS

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STEM MODULES FOR LESSONS & ACTIVITIES BOOK

Developed by EUROSUCCESS CONSULTING

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Subject: Renewable energies

<p>Contents:</p> <p>Getting to Know the energy of an offshore wind farm</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Discover specific themes and topics related to energy. ➤ Discover specific themes and topics related to renewable energies. ➤ Discover specific themes and topics related to marine energy resources. ➤ Discover specific themes and topics related to wind energy. ➤ Discover specific themes and topics related to offshore wind energy. ➤ Recognize the location where installing an offshore wind farm. ➤ Analyze the restrictions to the location of an offshore wind farm. ➤ Characterize the offshore wind energy farm. ➤ Know the power curve of the offshore wind turbine. ➤ Characterize the power curve of the offshore wind turbine. ➤ Calculate the Weibull probability density distribution. ➤ Calculate the energy produced by an offshore wind farm. ➤ Calculate the capacity factor of an offshore wind farm. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learning about the renewable energies. ➤ Understanding the importance of a sustainable and alternative way of producing energy. ➤ Learning about the use of a spreadsheet. ➤ Discovering geographical locations of their region, their country, or the entire world. ➤ Understanding the way of calculating the energy produced. ➤ Know the importance of the units of the International System. ➤ Assessing responsible energy consumption. ➤ Learning to teamwork. ➤ Learning to use truthful bibliographic information. ➤ Learning to do oral presentations. 	<p>Subject (s):</p> <p>Technology Maths Geography</p>
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<p>Target audience: 15 age</p>	<p>Typology: Project work</p>	<p>Duration/Program: 60 min</p>
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Materials: Computer devices with internet connection for each student group, Microsoft Excel (licenses will be given by the professor)



Activities and procedures

Activity 1: Before the lesson, students install the Microsoft Excel in their computers. The professor sends to students the spreadsheet template.

Activity 2: The students select the location where they want to install the farm. They should enter in the official webpage of ports of their country. In the case of Spain: <http://www.puertos.es/es-es/oceanografia/Paginas/portus.aspx>. They look for the wind resource parameters (scale parameter, shape parameter, anemometer height) and the depth of the location selected.

Activity 3: The students must select if the location selected is valid considering the restrictions (environmental protected areas, navigation areas, etc.) (see the map).

Activity 4: The students characterize the offshore wind farm (size and type of offshore wind platform: fixed or floating). They should research the present size of the offshore wind farms in Europe and the main types of offshore wind platforms installed in documents provided by WindEurope (<https://windeurope.org/>), European Wind Energy Association (EWEA) (<https://www.ewea.org/>) and National Renewable Energy Laboratory of USA (NREL) (<https://www.nrel.gov/>).

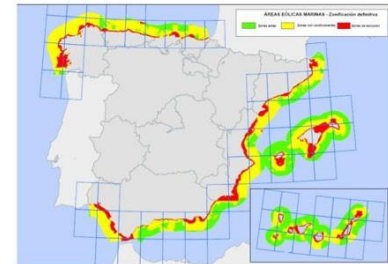
Activity 5: The students will identify the offshore wind turbine according to the platform selected and they should introduce in the spreadsheet its main parameters: power of the turbine (MW), rotor diameter (m), rotor height (m), cut-in speed (m/s), nominal speed (m/s), cut-out speed (m/s).

Activity 6: The students will introduce the power curve of the wind turbine selected in the spreadsheet and they will learn how to represent it in an Excel graph.

Activity 7: The students will calculate the Weibull probability density distribution in the spreadsheet. They will fill the spreadsheet using the scale parameter and the shape parameter of the offshore wind resource obtained previously. They will use the spreadsheet function =DISTR.WEIBULL(...).

Activity 8: The students will calculate the energy produced by one wind turbine, by the farm and its capacity factor.

Activity 9: Students will elaborate a report of the entire project and they will do an oral presentation. A specialized jury will evaluate their work.



Evaluation: The student discovers the energy produced by an offshore wind farm. They learn new sustainable ways of producing energy, which can make that the countries become more independent in energy terms.

Know +: <https://windeurope.org/>; <https://www.ewea.org/>; <https://www.nrel.gov/>; <https://www.idae.es/>; <https://lauracastrosantos.wordpress.com/>; <https://www.microsoft.com>



Subject: Hydrodynamics of artificial reefs in the Ares-Betanzos estuary

<p>Contents:</p> <p>Characterize the water field around and inside artificial reefs</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Understanding the beneficial aspects of artificial reefs. ➤ Understanding the hydrodynamics around and inside artificial reefs. ➤ Characterizing the current velocities in water ➤ Selecting the appropriate size of the nest cavities 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learning hydrodynamics. ➤ Understanding the velocity field in the seafloor. ➤ Designing artificial reefs. ➤ Learning biological aspects related to artificial reefs. ➤ Looking for information ➤ Learning to teamwork. ➤ Learning to use truthful bibliographic information. ➤ Learning to do oral presentations. 	<p>Subject (s):</p> <p>Engineering Maths</p>
<p>Target audience:</p> <p>15 age</p>	<p>Typology:</p> <p>Project work</p>	<p>Duration/Program:</p> <p>60 min</p>	

Materials: Computer devices with internet connection for each student group

Activities and procedures

Activity 1: The teacher will provide students the characteristic current velocities in the Ares-Betanzos estuary and a brief review of the main biological species in this estuary.

Activity 2: According to the species, the students must select the most appropriate location of the artificial reefs.

Activity 3: The teacher will provide to the students the typical hydrodynamic performance of an artificial reef and a proposed design.

Activity 4: The students will propose improvements to the proposed design.

Activity 5: The students will propose an artificial reef farm determining the distance separation between modules.

Activity 6: Students will elaborate a report of the entire project and they will do an oral presentation. A specialised jury will evaluate their work.



Evaluation: The students will learn how to design an artificial reef and an artificial reef farm according to hydrodynamic criteria.

Know +: <https://tecnologia-maritima.blogspot.com/>



Subject: Sinking of the Titanic

<p>Contents:</p> <p>Discover the change in behavior of materials due to external factors</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Understand the behaviour of materials. ➤ Discover the factors that modify the behaviour of materials. ➤ Learn to search for bibliographical records on a specific topic. ➤ Learn basic materials science laboratory techniques. ➤ Preparing the materials to be tested. ➤ Familiarize yourself with materials testing. ➤ Analyse the experimental data obtained. ➤ Relate the experimental data with the collected bibliographic data. ➤ Draw conclusions about the behaviour of materials. ➤ Assess what things need to be done to get the materials to behave as required. ➤ Present the results obtained. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learn to do a bibliographic search. ➤ Learn about materials science. ➤ Learn the importance of choosing a suitable material for the environment where you are going to work. ➤ Learn sample preparation techniques. ➤ Learn testing techniques for the mechanical behaviour of materials. ➤ Learn to work with experimental data. ➤ Learn to prepare reports. ➤ Learn to make public presentations. 	<p>Subject (s):</p> <p>Materials science, Technology</p>
<p>Target audience:</p> <p>15 age</p>	<p>Typology:</p> <p>Project work</p>	<p>Duration/Program:</p> <p>2 weeks</p>	

Materials: F-114 steel samples, metallographic saw, notching machine, hardness tester, Charpy pendulum with cold chamber, computer for data analysis and report writing

Activities and procedures

Activity 1: Students should become familiar with the Titanic accident, know the hypotheses about the causes of the accident and collect information about it.

Activity 2: Students will carry out a bibliographic compilation on the phenomenon of embrittlement of materials and the causes that generate this phenomenon.

Activity 3: Students will prepare the F-114 steel samples provided to them, cutting them to the appropriate dimensions and making the corresponding notches to carry out the Charpy impact energy tests.

Activity 4: Students will prepare the F-114 steel samples that are provided to them, preparing the surface adequately for carrying out hardness tests.

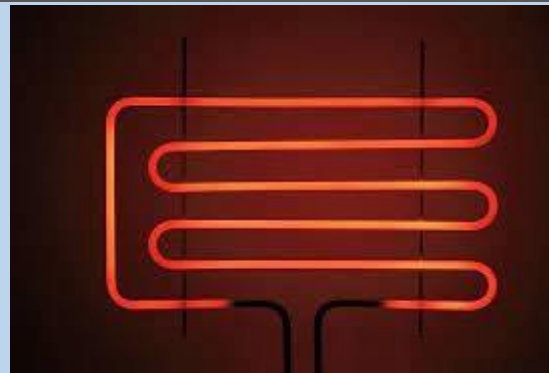
Activity 5: Students will perform Charpy impact tests on steel at room temperature, and at temperatures down to $-40\text{ }^{\circ}\text{C}$.

Activity 6: Students will analyse the experimental results obtained, drawing the corresponding conclusions about the modification of behaviour based on environmental conditions

Activity 7: Students will prepare a written report on the entire procedure, results and conclusions, and an oral presentation to defend their work in front of a court that will evaluate it.

Evaluation: Students will become familiar with materials science and experimental techniques, learning that the behaviour of materials can be influenced by external factors such as the environment.

Know +: Foundations of Materials Science and Engineering (Smith); The Science and Engineering of Materials (Askeland); Materials Science and Engineering: An Introduction (Callister)



Subject: Electric heating

<p>Contents: Discover the consequences of the Joule effect</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Familiarize yourself with basic concepts of electricity fundamentals. ➤ Familiarize yourself with Ohm's law. ➤ Discover the relationship between current intensity, voltage and electrical power of a conductor. ➤ Discover the relationship between current conduction and heating of the conductive element. ➤ Analyze the thermal behavior of the cable depending on its length, section and the current it carries. ➤ Analyze the voltage drop of the cable depending on its length, section and the current it carries. ➤ Analyze the results obtained and draw conclusions. ➤ Make a report with the work and the results obtained. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learn to do a bibliographic search. ➤ Learn to work with basic electrical circuits. ➤ Learn the relationship between tension, intensity and geometry of the conductor. ➤ Learn to quantify the losses that occur in the transport of electrical energy in the form of heat. ➤ Learn to select the cable depending on the working conditions ➤ Learn to synthesize the work done. ➤ Learn to speak in public. 	<p>Subject (s): Technology Electricity</p>
<p>Target audience: 11-15 age</p>	<p>Typology: Project work</p>	<p>Duration/Program: 1 semana</p>	
<p>Materials: Cables of different sections and lengths, two 230/12 V single-phase transformers, an infrared laser thermometer.</p>			
<p>Activities and procedures</p>			
<p>Activity 1: Students should become familiar with Ohm's law and the concepts of current, voltage, resistance, power, and the Joule effect.</p>			

Activity 2: Students will compile the necessary mathematical formulas to calculate power, intensity, voltage drop and resistance, as well as the relationship of these parameters with the temperature to which the cable heats up when it conducts electricity.

Activity 3: Students will design different electrical circuits, modifying the section of the conductor, its length and the voltage that circulates through them.

Activity 4: Students will connect the different conductors between the two transformers, measuring the temperature reached in the cable in each case.

Activity 5: Students will relate the temperature values obtained for each driver with the intensity that they drive.

Activity 6: Students will analyze the experimental results obtained, drawing the corresponding conclusions about the importance of choosing the appropriate conductor based on the intensity and voltage that will exist in the system.

Activity 7: Students will prepare a report that describes the knowledge acquired, the experimental procedure carried out and that relates the results obtained in the laboratory with the theoretical concepts described.

Activity 8: Students will make an oral presentation of their work.

Evaluation: Students will become familiar with the fundamentals of electricity and simple electrical circuit assemblies, learning that the proper selection of the conductor is essential for the proper functioning of any electrical system.

Know +: Electric circuits (Nilsson); Fundamentals of electric circuits (Alexander); Principles of electric circuits (Floyd)



Subject: Economic Advantages of Solar Energies

<p>Contents: Economic viability analysis of using solar energy at a household level</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Understand the advantages of these energies from an economic point of view. ➤ Know the public subsidies related to the installation of solar panels. ➤ Getting to Know the savings of using renewable energies at the household level. ➤ Discover specific themes and topics related to solar energy. ➤ Define the key or conditioning variables of the energy produced. ➤ Define the physical and atmospheric requirements to install solar panels. ➤ Analyse the options to the energy not consumed. ➤ Define the main characteristics of the project: size of the house, location, ... ➤ Study the levels of energy consumed during the last years in the house. ➤ Defined the initial investment of the project. ➤ Define the main cash-flows (incomes and payments) to include in the viability project for a defined time horizon. ➤ Know the useful life of a solar panel. ➤ Know the amortization period of the solar panels. ➤ Study the viability of the project using the main criteria such as NPV and IRR. ➤ Analyse the risks related to the project and, according to this, define different scenarios: case base, optimistic scenario and pessimistic scenario. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learning about solar energy. ➤ Solving an investment problem in a spreadsheet template. ➤ Learning the main elements to take into account in an investment project. ➤ Learning to apply the NPV and IRR as well as analysing their interpretations and interrelation. ➤ Understanding the concept of investment and its relationship with the interest rate ➤ Knowing the fundamentals and phases of the investment decision process. ➤ Understanding the elements involved in a solar project energy. ➤ Knowing the specific features of investments in a solar energy project. ➤ Learning the bases of decisions in a solar energy project. ➤ Learning to teamwork. ➤ Learning to manage confidently with the spreadsheet. ➤ Learning to do oral presentations. 	<p>Subject (s):</p> <p>Technology Finance Economics</p>
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Target audience: 15 age	Typology: Project work	Duration/Program: 60 min
Materials: Computer devices with internet connection for each student group, Microsoft Excel (licenses will be given by the professor)		
Activities and procedures		
<p>Activity 1: Introductory lecture where the main spreadsheet tools are explained in detail. In addition, lectures will provide students a file with the main formulas to be used.</p> <p>Activity 2: The students will define the house selected to develop the project. They should know the electrical energy consumption of that house to date in order to estimate the future savings. On the other hand, they will have in consideration the main characteristics of the house focusing on whether it is suitable for the objective.</p> <p>Activity 3: The students must contact with, at least, three companies to get three budgets of installation of solar energy. They will provide the companies the required information about the selected house. It is supposed they have prepared all these data in activity 2. If some data are not available, they will send the companies what they need.</p> <p>Activity 4: Once the students receive the budgets, they will decide which of them will take into consideration to develop the project. A recommendation will be to select the one with the most detailed and clearest information.</p> <p>Activity 5: The students will define the main elements of the project (initial investment, time horizon, cash-flows, interest rate) and introduce them in the spreadsheet provided by the lecturers. The students will have an extra-support of the lecturers to develop this part of the project as some tasks can be a bit difficult for the student (i.e.: how to manage with the spreadsheet template, to distinguish between investment and payment, to calculate the cash-flows corresponding to each period, ...)</p> <p>Activity 6: The students will find out the public subsidies they can apply for and will incorporate a hypothetical amount to the project in a base scenario (neither too optimistic nor too pessimistic).</p> <p>Activity 7: The students will calculate the viability of the project using the spreadsheet functions =VNA (...) and IRR (...).</p> <p>Activity 8: The students will undertake a sensitivity analysis considering two new scenarios (optimistic and pessimistic). They will identify the critical variables and introduce different values for the different scenarios analysing the impact on the results (VNA and IRR).</p>		
Evaluation: The student discovers the advantages produced by an installation of solar energy at a household level. The focus will be on the main economic advantages of providing this kind of energy from an economic point of view using an investment project as a main tool.		
<p>Know +: https://solarpowereurope.org/; EUsolarenergy; https://www.nrel.gov/; https://www.idae.es/; Instituto Galego de Promoción Económica - Igape; Ayudas IDAE</p>		



Subject: Financial implications of the energetic crisis

Contents:	Goals:	Skills:	Subject (s):
<p>Getting to Know the financial implications of the increase in the cost of the energy</p>	<ul style="list-style-type: none"> ➤ Knowledge of some important economic concepts and its evolution. ➤ Knowledge of the main financial concepts and its evolution. ➤ Understand the relation between the economic facts and the financial decisions. ➤ Be able to relate economic and financial information and how will affect to a company. ➤ Study the basis of the mathematics related to Finance. ➤ Design applications to calculate the financial costs of a company ➤ Special attention to the characteristics and operative of a loan. ➤ Calculate the increase of financial costs. ➤ Calculate the increase in financial profits. ➤ Understand the conditions of the ➤ Study of different scenarios. ➤ Be able to interpret economic and financial information ➤ Be able to think and reason in a financial way. 	<ul style="list-style-type: none"> ➤ Learning about economic terms. ➤ Study of the evolution of some economic terms. ➤ Learning about the use of a spreadsheet. ➤ Learn the specific mathematics behind the finance ➤ Know how to do applications related to financial products. ➤ Calculate the financial costs of a company. ➤ Discover the different variables that affect to financial cost ➤ Learn how to interpretate financial information. ➤ Learn how to understand the commercial decisions of the banks. ➤ Learning to teamwork. ➤ Learning to use truthful bibliographic information. ➤ Learning to do oral presentations. 	<p>Maths Finance Rate of interest Price of the energy</p>

Target audience: 15 age	Typology: Project work	Duration/Program: 60 min
Materials: Computer devices with internet connection for each student group, Microsoft Excel (licenses will be given by the professor)		
Activities and procedures		
<p>Activity 1: Before the lesson, students install the Microsoft Excel in their computers.</p> <p>Activity 2: The professor explains the different economic concepts.</p> <p>Activity 3: The students must search the relevant data and do the graphics of their evolution.</p> <p>Activity 4: The teacher explains the mathematics behind the finance</p> <p>Activity 5: The student does their own spreadsheet template to calculate the financial cost of a loan.</p> <p>Activity 5: The students will identify the variables that affect to the financial performance.</p> <p>Activity 6: The students will be able to introduce these variables in the excel application.</p> <p>Activity 7: The students will be able to introduce different scenarios</p> <p>Activity 8: The students will able to interpretate all the information handled.</p> <p>Activity 9: Students will elaborate a report of the entire project and they will do an oral presentation. A specialised jury will evaluate their work.</p>		
Evaluation: The student can design a financial application, using excel, to calculate the financial consequences of the changes of the economic and finance variables. The student know how to relate the different variables and to interpret the results.		
Know +: https://www.ine.es/ , https://www.ecb.europa.eu/ecb/html/index.es.html , https://www.bde.es/bde/es/ , https://www.tesoro.es/		



Subject: Analysis of waste generation, collection and treatment in Spain and Europe

<p>Contents:</p> <p>To deepen the understanding of the importance of waste collection and treatment.</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Discover topics related to Sustainable Development that are new to students because they are not included in secondary school curricula. ➤ Improve the ability to work in a team ➤ Learn how to search for information on a new topic ➤ Understand what waste collection and waste treatment are and how they are important in order to achieve several of the Sustainable Development Goals. ➤ Learn how to synthesise and structure the available information. ➤ Learn how to make comparative analyses between countries. ➤ Improve written expression, drafting in a careful and rigorous manner ➤ Learn how to produce graphs and tables ➤ Learn to draw personal conclusions and develop critical thinking skills. ➤ Improve oral expression and the ability to defend one's ideas in public. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Be able to understand what waste is, what types of waste there are and what treatment techniques can be applied. ➤ Be able to coordinate with other students and organize group work. ➤ Be able to search for information and data in different sources (books, websites, databases, etc.). ➤ Be able to understand what happens with waste generation, collection and treatment in Spain and other European countries. ➤ Be able to work effectively with multiple data and documents from different sources. ➤ Be able to handle data from different countries and compare them in order to understand differences and similarities between those countries. ➤ Be able to develop a simple and careful writing style without copying sentences or paragraphs from other authors. ➤ Know how to cite the documents consulted in an appropriate manner. ➤ Know how to prepare a bibliography ➤ Be able to work with an Excel spreadsheet. ➤ Be able to work with a presentation software (such as PowerPoint or Canva). ➤ Be able to express one's own opinions on the subject studied and justify them in a reasoned manner. ➤ Be able to present the project in front of a specialized jury and to answer the questions raised, reasoning and justifying the answers. 	<p>Subject (s):</p> <p>Science Technology Sustainable development Maths</p>
<p>Target audience: 15 age</p>	<p>Typology: Project work</p>	<p>Duration/Program: 2 academic years</p>	

Materials: Computer devices with internet connection for each student group, Microsoft Excel (licenses will be given by the professor)

Activities and procedures

Activity 1: Before the lesson, students should install the Microsoft Excel spreadsheet in their computers

Activity 2: Students should attend an introductory class to learn how to search for documents and data.

Activity 3: Students should search for information to:

- Understand what waste is and why it is produced
- Understand why the collection and treatment of waste is important and relate those concepts to the Sustainable Development Goals.
- Know the types of waste that can be generated and classify them according to several criteria.
- Know the existing waste treatment techniques

Activity 4: Before starting to write, students must attend a class in which they are explained how to cite documents and construct a bibliography. Various styles of bibliography will be presented, although students should follow the APA style. This class will be taught in collaboration with the library staff of the Faculty of Economics and Business.

Activity 5: After reading and critically analyzing the information found, students should start writing the introduction and the first points of the project report.

Activity 6: Students should search for data to study the GENERATION of waste in Spain distinguishing between: types of waste, hazardousness, and sectors of activity in which waste is generated (www.ine.es). Students will then produce their own graphs and tables and interpret the results.

Activity 7: Students should search for data to study the waste COLLECTION in Spain distinguishing between Autonomous Communities (www.ine.es). Students will then elaborate their own graphs and tables and interpret the results.

Activity 8: Students should search for data to study of the TREATMENT of waste in Spain (www.ine.es). Students will then produce their own graphs and tables and interpret the results.

Activity 9: Students should search for data search to make a comparative study on waste generation, collection and treatment at European level (<https://ec.europa.eu/eurostat/web/waste/data/database>). Students will then produce their own graphs and tables and interpret the results.

Activity 10: Students should finalize the project report and build up the bibliography.

Activity 11: Students should prepare the oral presentation of the project and supporting materials. This would be followed by a rehearsal of the oral presentation.

Activity 12: Students should present the project in front of a specialized jury that will evaluate it.

Evaluation: Students should understand what waste generation is and the importance of waste collection and treatment in contributing to the achievement of the Sustainable Development Goals. Students should carry out the study for Spain and compare it with other European countries.

Know +: <https://ecolec.es/informacion-y-recursos/tratamiento-de-residuos/> ; https://www.miteco.gob.es/es/calidad-y-evaluacion-ambiental/publicaciones/memoriaanual2019generacionygestionresiduosrescompetenciamunicipal_tcm30-534462.pdf ; <https://www.ecoembestransparencia.com/datos/envases-domesticos-ligeros/#content-datos-recogida> ; <https://www.microsoft.com>



Subject: Materials and composition of green artificial reefs in the Ares-Betanzos estuary

<p>Contents:</p> <p>Characterize the composition and materials of concrete artificial reefs</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Understanding the beneficial aspects of artificial reefs. ➤ Understanding the possibility in the use of green artificial reefs. ➤ Characterizing the composition ➤ Selecting the appropriate materials components 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learning Science of materials. ➤ Understanding the concept of circular economy and marine ecosystem products. ➤ Designing artificial reefs. ➤ Learning biological aspects related to artificial reefs. ➤ Looking for information ➤ Learning to teamwork. ➤ Learning to use truthful bibliographic information. ➤ Learning to do oral presentations. 	<p>Subject (s):</p> <p>Engineering Maths</p>
<p>Target audience:</p> <p>15 age</p>	<p>Typology:</p> <p>Project work</p>	<p>Duration/Program:</p> <p>60 min</p>	

Materials: Computer devices with internet connection for each student group

Activities and procedures

Activity 1: The teacher will provide students the characteristic current velocities in the Ares-Betanzos estuary, a brief review of the main biological species in this estuary and the type of component-materials used in the construction of artificial reefs.

Activity 2: According to the species, the students must select the most appropriate location of the artificial reefs.

Activity 3: The teacher will provide to the students the typical components used in the construction of concrete artificial reef and a proposed design.

Activity 4: The students will propose possibilities in the composition in order to obtain a green artificial reef - GAR.

Activity 5: The students compare the different options and will propose an green artificial reef composition.

Activity 6: Students will elaborate a report of the entire project and they will do an oral presentation. A specialised jury will evaluate their work.

Evaluation: The students will learn how to design the composition of green artificial reef according to materials science.

Know +: <https://tecnologia-maritima.blogspot.com/>



Subject: States of matter

<p>Contents:</p> <ul style="list-style-type: none"> • Physical states of matter. • Molecular kinetic theory. • Laws of gases. 	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Learning what the different states of matter and their characteristic properties are. ➤ Relating the states of matter with the molecular kinetic situation of its particles. ➤ Identifying situations in everyday life in which we encounter changes of state and work them applying scientific reasoning. ➤ Learning to graphically represent data in which state changes occur. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Enhancing teamwork and individual work. ➤ Finding the taste to work methodically and orderly. ➤ Properly managing the different laws of gases with graphs and formulas. 	<p>Subject (s):</p> <p>PHYSICS</p>
<p>Target audience: 14-15 age</p>	<p>Typology: Tasks related to the differentiation of the physical states of matter, in everyday life as well as the resolution of exercises related to the laws of gases and to the investigation of whether kinetic theory was elaborated by a single scientist and whether this process of elaboration of theories is rare within Physics.</p>		<p>Duration/Program: 200 minutes</p>

Materials: Student book, digital resources, some others.

Activities and procedures

Activity 1: Is a crystal a solid or a liquid?

Activity 2: Classify the following material bodies and systems according to whether they are solid, liquid, gaseous or have other states: sun, sea water, atmosphere, moon, Antarctica, Amazon River.

Activity 3: Applying the Gay-Lussac law, complete the following table for heating a gas at constant volume and perform the p-T graph.

T(K)	P(atm)
300	1,5
350	
	2
600	

Activity 4: Investigate whether Kinetic Theory was elaborated by a single scientist.

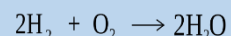
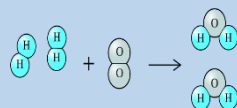
Activity5: Define:

- Vaporization
- Evaporation
- Boiling

Evaluation: We have devised several ways:

- Presentation: Students explain what they know and share it with their classmate.
- Digital brochure: Students condense information on the topic and synthesise what they have learned.
- Debate: Students adopt different roles and rely on their knowledge to argue with their opponents (classmates/ cooperative).
- Heading.

Know +: Perform the same tasks, investigating how they would do it in another country.



Subject: CHEMICAL CHANGES

<p>Contents:</p> <ul style="list-style-type: none"> • What are chemical reactions? • Mechanism of a chemical reaction: theory of collisions. • Chemical equation. Adjustment. • Types of chemical reactions. • The speed of a chemical reaction. Factors that modify it. • Energy of reactions. 	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Writing and recognizing chemical equations. ➤ Adjusting chemical reactions. ➤ Identifying and classifying the types of chemical reactions. ➤ Recognizing the influence of factors on the speed of chemical reactions. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Interpreting simple chemical reactions using collision theory. ➤ Performing experiments to obtain precipitates by reaction between (e.g.) potassium iodide and lead(II) nitrate ➤ Predicting the effect of the concentration of solid reagents and catalysts on reaction rate (e.g., addition of potassium iodide to the breakdown of oxygenated water). ➤ Analyzing the effect of factors that affect the speed of a chemical reaction, either through laboratory experiences or through interactive virtual applications in which the manipulation of variables allows conclusions to be drawn. ➤ Determining the endothermic or exothermic character of a chemical reaction by analyzing the associated reaction heat sign. 	<p>Subject (s):</p> <p>Physics and Chemistry</p>
<p>Target audience: 15 years old</p>	<p>Typology: Project work</p>	<p>Duration/Program: 100 min</p>	
<p>Materials: Laboratory equipment for visualizing the influence of the various factors on the reaction speed.</p>			



Activities and procedures

Activity 1: Classify a series of chemical reactions according to the exchange mechanism and the particles exchanged:

Activity 2: Investigate which acids or bases are present usual substances (lemon juice, vinegar, bleach, ammonia, ...).

Activity 3: Investigate what is the octane index of a gasoline. What effects does it have on engine combustion?

Activity 4: Learn about the energetic nature of the photosynthesis reaction.

Evaluation: Students will be able to adjust and classify chemical equations. And also to explain how usual chemical reactions are affected by modifying any of the factors studied.

Know +: <https://links.edebe.com/ppu7>



Subject: Rain gauge & Windsock

Contents:

Learning about weather conditions and how to estimate them.

Creating a rain gauge and a windsock from recycling materials.

Goals:

- Creating a rain gauge and a windsock from recycling materials (cans, plastic, etc.).
- Observing the climatic elements (direction of wind, rainfall height) and write down their calculations.
- Gaining skills and competences in cooperation and teamwork activities.

Skills:

- Teamwork
- Craft skills
- knowledge about climate elements

Subject (s):

Mathematics,
Engineering,
Science.

Target audience: 13-16 age	Typology: Project work	Duration/Program: 3 hours	
Materials: cans, pencil, cardboard (thin and thick), clay, straws, juice, needle/pin, compass, plastic bottle, cutter, ruler, scissors, transparent adhesive tape			
Activities and procedures			
A.1. : Divide the students in four groups (depends on the total number, preferred number in each group: 5 students). Two groups will create a rain gauge and the other two a windsock.			
<p>Windsock:</p> <ul style="list-style-type: none"> • Open a hole in the bottom of the can. • Draw the points of the horizon outside from the can and make two diameters. The edges of these two diameters are the points that you need. Define the north by using the compass. • Pass the pencil from the hole at the bottom. • Turn the can upside down and place it on the thick cardboard. • Fix the can with the clay. • Cut two equilateral triangles by using the think cardboard. • Cut the both edges of a straw and place the triangles there. • By using the pin, attach the straw on the pencil. • Go outside and try the windsock. The purpose of the windsock is to show the wind direction. 		<p>Rain Gauge:</p> <ul style="list-style-type: none"> • Take the plastic bottle and count with the ruler 25cm. from its bottom. Cut round the upper part of the bottle, and place the cropped piece upside down, you can use the adhesive tape to fic it. In this way, you can avoid the evaporation of water and maintain the level of water. • Place the rain gauge outside at an elevated place, without being covered, in order the rain can go inside. • In order to calculate the high of the rain, put the ruler parallel to the bottle and observe the indication of the ruler (in millimeters), at the water surface. This indication is the high of the rain. • Before using the rain gauge, try I with using tap water. 	
Evaluation: Students can conduct results by the calculations. Students can discuss about climate elements and changes.			
Other Links: http://deukalion.sch.gr/wp/wp-content/uploads/2022/3dra/dra24.pdf			



Subject: Air pollution

Contents:

Role play and research on air pollution causes and effects (natural causes and human interference).

Goals:

- Definition of air pollution's resources.
- Find out the consequences on people's health
- Taking specific measures for the limitation of air pollutants.
- Recognizing the necessary actions that are needed in personal level for the limitation of air pollution.
- Gaining skills and competences for cooperation and teamwork.

Skills:

- Knowing the consequences and effects of air pollution in the environment.
- Define the causes of air pollution and its definition.
- Conduct research and analyze the results.
- Development of teamwork skills and cooperation mentality.
- Understanding the importance of changing some personal habits in order to help the reduction of air pollution.
- Communicational skills.
- Negotiation techniques.

Subject (s):

Science, physics, technology.

Target audience: 13-16 age	Typology: Project work	Duration/Program: 1 school week	
Materials:			
Activities and procedures			
Let's build a role play with the topic of "Air pollution in our region" .			
<p>Scenario: It is announced at the radio that the air pollutants in your region are at the highest levels, setting up by the Global Health Organization. The school principal puts forward for discussion the issue of air pollution. Where is due to this pollution? Which are the consequences on people's health? Which action should be happened, in order to track the sources of this pollution, and so these pollutants to be limited and the situation get better?</p>			<p>Roles: representative of the local authority, experts (chemical, doctor, etc.), residents, students and parents.</p>
<ol style="list-style-type: none"> 1. It is not necessary to keep all the roles above or exactly the same scenario, you can add yours and details. 2. Then, create your working teams and the coordinator in each group. 3. Read the scenario and your role properly, which are the main characteristics, mark some potential ideas or opinions of your representative. Make research based on the topic and your character, find information about air pollution and mostly in your region (legislations, initiatives, actions, etc.). 4. You need to put some deadlines about the research and the day that the play will take place. 5. The teacher can be the facilitator of the process or a student can be, it is up to you. 6. During the play, each team will present its arguments, ideas, results from research, depends on its role represented. 7. Following the end of this role play game, you need to write down a text with the results of this conversation about air pollution, with both sides arguments and all opinions/ideas. 8. Then, write down an article which will be published at a local magazine, newspaper or website presenting your research and results, and also, which actions you propose in order to limit air pollution in your region. 			
→During the research, you can plan a visit at a local institute related to the topic, in order to collect more information, or have an interview with a real expert.			
At the end, is also useful, to write down in a poster all the factors that can cause air pollution, both natural and human interventions (e.g., smoking in an interior place, fires, chemical products, etc.), and share it on social media for raising public awareness.			

Evaluation:

Students learn about air pollution, causes, effects, consequences and ways to limit it. Also, they practice on research and negotiation techniques.



Subject: The quality of water in our school

Contents:

Water quality.
Scientific calculations.
Basic water quality and affection on people's health.

Goals:


- Report in which factor is based the control of water quality.
- Gain skill about how to make scientific calculations.
- Check the water quality in your school.
- Learn which factors affect the water quality.
- Find how people can control the affection of water quality.
- Make presentation of your results.

Skills:

- Learning about the standards of water quality.
- Conducting scientific calculations and use specific materials.
- Conducting research about water quality.
- Find solutions.
- Make presentations.

Subject (s):

Science, technology, mathematics.

Target audience: 13-14 age	Typology: project activity	Duration/Program: 120 min	
Materials: pencils, notebooks, papers of PH calculation/ PH-meter, temperature calculator and water hardness meter (can be found in pharmacies), camera.			
Activities and procedures			
<p>A.1. : Divide the students into groups of five (5) people (depends on the student's total number).</p> <p>A.2. : The teacher will show how to use the materials of calculation (PH-meter, temperature calculator, etc.), make sure that all children understood the use.</p> <p>A.3. : Each group will choose a tap/ sink in school, which calculate the water quality, by using a "case study" paper (included: date, time, group name, student's name, sink's location).</p> <p>A.4. : Add some tap water in a glass and observe it carefully: How is it? Clear or blurry? Try its taste, smell it and write down how it tastes and smells.</p> <p>A.5. : Fill two more glasses. Create a group that will calculate the PH, another one that will calculate the temperature and one last that will calculate the hardness of water.</p> <p>A.6. : Conduct research about the main limits of water's temperature, hardness and PH.</p> <p>A.7: Compare your sample's calculations with the limits you found and write down your observations and results.</p>			
			
Evaluation: Discussion about the water quality in your school, find some potential solutions to propose to your principal of your school. Make a presentation of your research and results for your school.			



Subject: Exploring the Solar System

Contents:

Learning about solar system.
Learning about planets' characteristics.
Learn how to count their distance.

Goals:

Students will be able to:

- Identify and describe the eight planets in the solar system.
- Explain the characteristics of the inner and outer planets.
- Analyze and interpret data related to the planets' physical properties and their distances from the sun.

Skills:

- Team work.
- Creating graphs.
- Presentation skills.
- Using technology and internet.

Subject (s):

Science, technology

Target audience: 11-13 age	Typology: project activity	Duration/Program: 90 min	
Materials: computer/laptop with internet access, projector/screen, solar system diagrams, measuring tape, worksheets.			
Activities and procedures			
<p>A.1.: The teacher asks the students if they know the eight planets in the solar system. He/ She can show a diagram of the solar system and ask the students to point out the planets.</p> <p>A.2. : Explaining about the inner and outer part of the solar system and which planets included in each of them. Discuss the characteristics of the planets from each part (e.g., their surface, the proximity to sun, the lack of rings and moons, etc.).</p> <p>A.3. : Then, divide the class into groups of three or four persons (depends of the total number).</p> <p>A.4. : Provide each group with a worksheet that contains data about the physical properties of the planets (e.g., size, temperature, distance from the sun, number of moons, etc.).</p> <p>A.5. : Ask students to analyze data and create a chart/graph that shows the differences and similarities between the planets.</p> <p>A.6. : After completing the chart/graph, ask students to present their findings to the class.</p> <p>A.7. : Show to students a diagram that represents the distance between the sun and each planet. Ask them to measure the distance between the sun and each planet with using the measuring tape.</p> <p>A.8. : Discuss the relative distances between the planets and how they affect the planets' characteristics.</p> <p>A.9. : As a conclusion, review the eight planets and their characteristics. Ask students to reflect on what they learned and how they can apply their knowledge to real-life situations.</p>			
Evaluation: Students will be assessed based on their participation in class discussions, completion of the worksheet, and their ability to create and present a chart or graph that shows the differences and similarities between the planets.			



Subject: Solar energy heater

Contents:

Learning and creating a solar energy heater.

Goals:

- Learning of solar energy and its use. Advantages and disadvantages by using solar energy.
- Making research about the different ways of using solar energy.
- Creating a solar energy heater from recycling materials (cans).
- Be able to present the heater in the class and explaining its use.


Skills:

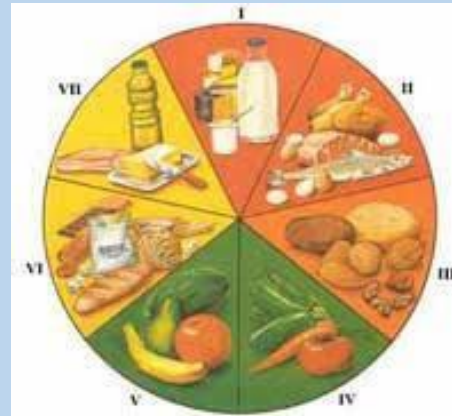
- Understanding of different types of energy, especially solar energy.
- Find different ways of producing energy and creating stimulations.
- Presentation of results in front of the class.

Subject (s):

Science, technology, arts, mathematics.



Target audience: 13-16 age	Typology: project activity	Duration/Program: 120 min	
Materials: computers, cardboard boxes, black paint, scissors, glue, aluminum foil, duct tape, plastic tubing, empty cans.			
Activities and procedures			
<p>A.1. : Teacher will show a video about solar energy and its use. Then, there will be a discussion about solar energy, based on the video, in the class.</p> <p>A.2. : Students will be divided in groups (depends on the total number) and they will conduct research about the advantages and disadvantages of using solar energy.</p> <p>A.3. : Each group will make a presentation of its research and explaining the results.</p> <p>A.4. : Teacher will show on internet some pictures of DIY solar energy heaters (in order to help students about how they look like).</p> <p>A.5. : Each group will gather the materials, calculate, design, search and create its solar energy heater.</p> <p>A.6. : During the process each group will take notes about the process and by the end they will have an essay about how they made it. In this essay, students will include the purpose of creating this heater and the benefits of using it.</p> <p>A.7. : Groups will present their final project: be sure that you will include the purpose and how it is beneficial residentially.</p>			
			
Evaluation: Students will be able to present the benefits of using solar energy, and also, they will know the use of a solar energy heater.			
<p>Other links: https://www.google.com/imgres?imgurl=https://i.ytimg.com/vi/IvEfmDH_Y2o/maxresdefault.jpg&imgrefurl=https://www.youtube.com/watch?v%3DIvEfmDH_Y2o&docid=gP4pffoIV0cFzM&tbnid=t04CokZUtNxGZM:&vet=1&w=1280&h=720&source=sh/x/im&sfr=vfe </p>			



Subject: What do we eat?

Contents:

- Food and nutrition.
- Diet and health.
Balanced diet.
- Healthy nutritional habits.
- Eating disorders.

Goals:

- Being able to recognise the differences between nutrition and eating.
- Analysing which diets are beneficial.
- Identifying the illnesses and disorders that come from bad eating habits
- Recognising the importance of eating habits and of physical exercise in your health.

Skills:

- Identifying the equipment and systems that intervene in the function of nutrition.
- Realising the importance of eating habits and nutrition for a well-function in the organism recognising the differences between eating and nutrition, and being able to differentiate the nutrients and their basic functions.
- Being able to identify every nutrients function in the organism, and recognising healthy nutritional habits.
- Designing healthy nutritional habits through the elaboration of balanced diets, using charts with the food groups with the main nutrients you can

Subject (s):

Biology

		<p>find in them and their caloric values.</p> <p>➤ Valuing and finding a balanced diet for a healthy life and identifying the principal disorders in their eating habits.</p>	
<p>Target audience: 14 years</p>	<p>Typology: Project/task</p>	<p>Duration/Program: 4 sessions de 50 minutes</p>	
<p>Materials: labels of packed foods, cooking books, nutrition charts, food wheel, notebook, calculator, internet...</p>			
<p>Activities and procedures</p>			
<p>Activity 1: The students will pick up nutritional data from the labels on the food they bring to class. In the case that their food is fresh, they'll search the information on the Internet. In each food they'll write down if, in their opinion it's a healthy food or not</p> <p>Activity 2: Calculate your BMR (basal metabolic rate) and the calories you consume in a day.</p> <p>Activity 3: Prepare a diet that meets your caloric needs.</p> <p>Activity 4: Search for information on food-related diseases: malnutrition, deficiency diseases, allergies...</p>			
<p>Evaluation: - Create a scheme in which healthy eating is the main theme from which all the recommendations start.</p> <ul style="list-style-type: none"> - From a list of foods, classify them according to their plastic, energetic or regulatory function. - Choose a product that you regularly consume and classify the information included in the label. Then, answer: <ul style="list-style-type: none"> a. What is the amount of calories provided by 100 g or one serving? b. What nutrients does it contain? Specify the amounts of each of them. c. Does it include the best before or expiration date? What is the difference between these two concepts? d. What type of conservation is required? e. What is the most abundant ingredient? f. Does it refer to some type of allergen or ingredient that causes intolerance? 			
<p>Know +: https://estilosdevidasaludable.sanidad.gob.es/alimentacionSaludable/home.htm</p>			



Subject: Mixtures

Contents:

Learning about different mixtures and their differences.

Goals:


- Students will exercise in scientific procedures (observation, calculation, experiment, interpretation of results, communication, etc.).
- They will be able to divide the materials of mixtures with sorting, sifting, attraction with magnet and filtration.
- Connection of science's application in everyday life.

Skills:

- Observation
- Communication
- Science knowledge
- Practical skills about experiments
- Team work

Subject (s):

Science

Target audience: 13-16 age	Typology: Activity	Duration/Program: 120 min	
<p>Materials: solid materials (e.g., sugar, coffee, salt, etc.), water, liquid materials (e.g., oil, vinegar, etc.), vessels for blending, spoon (or something else for blending), measurement vessel/scale</p>			
<p>Activities and procedures</p>			
<p>A.1. : The students calculate and write down the materials: they sort the materials (liquids and solid materials). A.2. : The students are separated in teams (depends on the total number). A.3. : Each team chose three solid materials, in order to create mixtures between two of them, and also, to have the opportunity changing into all possible combinations. A.4. : The teams need to write down the materials they used in each mixture, the amount and the final mixture that they created. A.5. : They repeat the procedure with liquid materials, and also, with a liquid and a solid material. A.6. : After finishing the mixtures they discuss about what they observed, the difficulties and the results. A.7. : Then, the teacher asks them to think about this kind of mixtures that they use in their everyday life.</p>			
			
<p>Evaluation: The students will be able to recognize the type of the mixture and the final result of blending solid and liquid materials and how they react. Also, they will be able to recognize this type of mixtures in their everyday life.</p>			



Subject: Genetically Modified Organisms (GMO)

<p>Contents:</p> <ul style="list-style-type: none"> ➤ Applications of genetic engineering. Biotechnology. Bioethics. 	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Recognising the application of genetic engineering: genetically modified organisms (GMO) ➤ Evaluating and interpreting the applications of recombinant DNA technology in agriculture, in livestock, in the environment and in health. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Analysing the ethical, social and environmental implications of genetic engineering. ➤ Critically interpreting the consequences of two current advances in the field of biotechnology. 	<p>Subject (s):</p> <p>Biology</p>
<p>Target audience: 15 years</p>	<p>Typology: Work</p>	<p>Duration/Program: 50 minutes</p>	
<p>Materials: Computer, Internet</p>			



Activities and procedures

Activity 1: Look for foods that are commonly consumed, genetically modified and properly labeled.

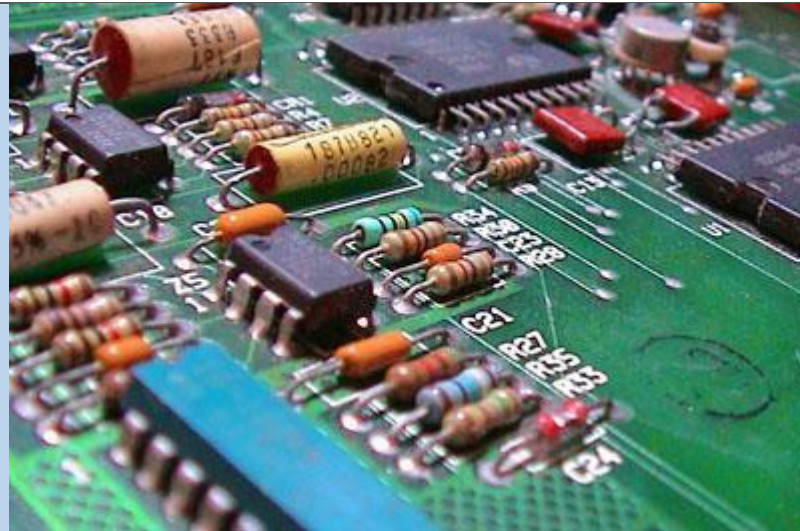
Activity 2: Seek information on the benefits and harms of growing and consuming transgenic foods.

Activity 3: Describe the applications of biotechnology in different fields.

Activity 4: With the information gathered, we can share information during the class and discuss the importance of investing money in research on different biotech applications.

Evaluation: Make a digital presentation with examples indicating the contribution of genetic engineering and biotechnology to medicine, pharmacology, agriculture, livestock and the environment.

Know +: <https://www.ocu.org/alimentacion/seguridad-alimentaria/informe/ogm-respondemos-a-sus-preguntas500144>



Subject: Building a bridge with recycled material

Contents:

Bridge construction with recycled material

Goals:

- Discovering the beginnings of structure architecture.
- Analyzing the evolution of bridges valuing the most significant advances.
- Discovering the different building materials.
- Discovering bridge building techniques.
- Analyzing the loads suffered by the different parts of the bridge.
- Recognizing the best structures for the manufacture of bridges.
- Design of structures and bridges.
- Analyzing recycled elements useful for the construction of a bridge.
- Elaboration of a bridge model with recycled materials.

Skills:

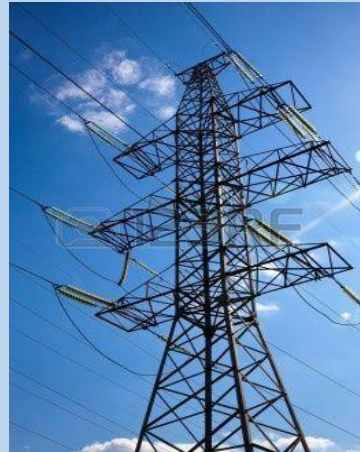
- Knowing the evolution of bridge construction.
- Knowing the materials used in the construction of structures.
- Understanding the importance of loads in structures.
- Learning to work in a team.
- Learning to self-learn.
- Learning to design structures.
- Developing creativity.
- Understanding the importance of recycling.
- Designing and building a bridge with recycled material.

Subject (s):

Technology
Mathematics
Physics
Plastic

Target audience: 11-12 age	Typology: Project work	Duration/Program: 120 min	
Materials: Computers with internet connection. Projector and speakers. Recycled material for the construction of the final project.			
Activities and procedures			
<p>Activity 1: Perform a search for the most significant bridges. No matter the year of construction.</p> <p>Activity 2: In groups you will search the internet for the evolution of the materials used in the construction of bridges and then share it with the rest of the class.</p> <p>Activity 3: Brainstorming the different uses of bridges.</p> <p>Activity 4: With the help of a mentor learn the different loads that influence a structure.</p> <p>Activity 5: Students must make a sketch of the bridge they wish to build with the loads that the structure will suffer.</p> <p>Activity 6: Perform a new search in which students will review bridges with similar structure to the chosen one and make modifications to improve the sketches elaborated.</p> <p>Activity 7: Select recycled material that can be used as structural elements of the bridge.</p> <p>Activity 8: Design of the final product.</p> <p>Activity 9: Project construction.</p>			
Evaluation: Students learn about structures, material recycling and bridge construction			
Know +: https://www.youtube.com/watch?v=7H_qqaMd_I0 ; https://theconstructor.org/ ; https://www.youtube.com/watch?v=o4eM0qoUhaE ;			

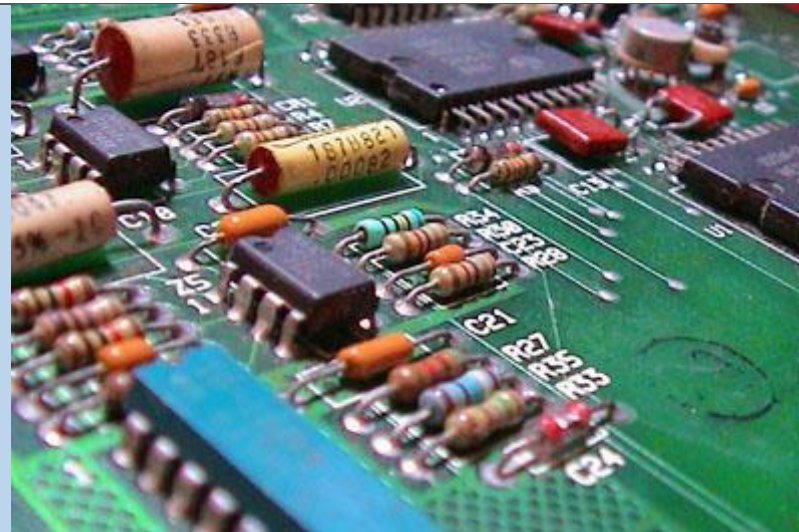




Subject: STRUCTURES

Contents:	Goals:	Skills:	Subject (s):
<ul style="list-style-type: none"> • The structures that surround us. Biomechanics. • What are the structures for? Types of structures. Elements of a structure. • Design of a structure. 	<ul style="list-style-type: none"> ➤ Managing basic concepts of forces. ➤ Identifying structures in our environment; relating natural structures with those created by humans. ➤ Knowing the different types of structures depending on the elements that compose them and their functionality. ➤ Distinguishing the loads and types of effort to which structures are subjected. ➤ Understanding the importance of the shape and material used in structures. ➤ Characterizing the factors involved in the stability of structures. ➤ Working collaboratively respecting the opinions of others and agreeing on the final solution. 	<ul style="list-style-type: none"> ➤ Describing orally and in writing the characteristics that make up the types of structures, relying on written information. ➤ Identifying the characteristic stresses and their transmission in the elements that make up the structure. 	<p>Technology</p>

Target audience: 13 years	Typology: Project	Duration/Program: 6 sessions of 50 minutes	
Materials: computers with internet connection, cardboard, waste paper, glue, silicone gun, scissors, cutter...			
Activities and procedures			
<p>Activity 1: In groups of three, we suggest that you look at natural structures and think about how we could use them to design artificial objects. To begin with, you can think of these structures: spider web scales of a fish legs of a crab Are there artificial structures that have already imitated these natural forms?</p> <p>Activity 2: Look for emblematic buildings in your city and identify some reference to nature..... Look at different shelves. Evaluate the differences between them in terms of the function they perform, the material they are made of, their shape and the distribution of the load.</p> <p>Activity 3: Identify different types of structure in your environment.</p> <p>Activity 4: Look at different shelves. Evaluate the differences between them in terms of the function they perform, the material they are made of, their shape and the distribution of the load.</p> <p>Activity 5: Build a truss-type structure made of paper that supports 5 kilos and that we can use to save a maximum distance of 20 cm. We will reuse paper that has already been used at school, for which we will create a collection point and invite all members of the center to participate in this initiative. Do you dare this challenge?</p>			
<p>Evaluation: Finally, prepare the final report following the script: PROPOSAL, DEFINITION OF THE PROBLEM, FINAL SOLUTION, DESIGN, CONSTRUCTION, EVALUATION. With the photographs taken throughout the construction, prepare a presentation to disseminate your work to the rest of the class.</p>			
<p>Know +: https://www.apuntesmareaverde.org.es/grupos/tec/lomce/2eso/estructuras.pdf https://www.aulatecnologia.com/ESO/SEGUNDO/teoria/estructuras/ESTRUCTURAS.htm</p>			



Subject: Simulating and assembling circuits

Contents:

Learning Electrical Circuits with Crocodile Clips

Goals:

- Discovering the beginnings of electronics and their applications.
- Analyzing the evolution of electronics evaluating the most significant advances.
- Comparative of modern-classic technology.
- Discovering current electronics and their applications.
- Recognizing the main components of an electrical circuit.
- Installing the specific software practices.
- Analysis and resolution of basic circuits using Crocodile Clips software.
- Use and management of the polymer.
- Performing measurements by simulating circuits and taking measurements.

Skills:

- Knowing electronics and the fundamental laws that govern it.
- Knowing the history of electronics and its relationship with technology.
- Learning to solve simple electrical circuits.
- Knowing how to work with electronic components and taking different measurements.
- Learning to self-learn.
- Knowing the steps to install a program on your computer.
- Learning to work with Crocodile Clips.
- Learning to assemble basic circuits physically and in simulation.

Subject (s):

Technology
Electronics
Maths

	<ul style="list-style-type: none"> ➤ Basic electrical circuit assembly (bulb, switch, LED and battery). ➤ Comparative analytical and experimental measures. 		
Target audience: 15 – 16 age	Typology: Project work	Duration/Program: 120 min	
Materials: Computers with internet connection. Electronic equipment (bulb, switch, LED, battery, polymer, etc)			
Activities and procedures			
<p>Activity 1: Students will download and install the internship software.</p> <p>Activity 2: Search for information on the evolution of technology. We divide the class into 3 groups (one will look for the origins, other the evolution and other the news of electronics).</p> <p>Activity 3: A spokesperson is appointed from each group that will expose the three most important milestones of the research carried out in activity 2 to the other colleagues.</p> <p>Activity 4: Explanation by the teacher of the different electrical components and delivery of the material necessary for the assembly of the final circuit.</p> <p>Activity 5: Students must self-learn with the help of the internet how to work with the software and simulate the circuit they will later physically ride.</p> <p>Activity 6: Students will take measurements of voltage, intensity and resistance consumption and file it in a spreadsheet to subsequently make a comparison with the real and simulated values.</p> <p>Activity 7: Explain the use of the polymer and proceed to the assembly of the final circuit.</p> <p>Activity 8: Comparative results and final conclusion.</p>			
Evaluation: Students learn electronics and how to simulate circuits for testing before actual assembly.			
Know +: https://www.youtube.com/watch?v=JG1wiCiLrQo ; https://www.electronicandyou.com/basic-electronic-components-types-functions-symbols.html ; https://www.tutorialspoint.com/electronic_measuring_instruments/measuring_instruments.htm ;			



Subject: Reusable Robot

Contents:

Discover the materials that can be reused and the importance of recycling.

Goals:

- Realizing the importance of recycling.
- Learning which materials are reusable.
- Develop skills for creating a robot.
- Develop creativity and arts.
- Use of technology for research and information.
- Learning the harmfulness of some materials for the environment.
- Planning and idea for a new constructure.
- Preparation of a prototype of a robot.
- Use of the improvisation of process cycle.
- Use of mechanics and engineering.

Skills:

- Learning the importance of teamwork, leadership and organizational structures.
- Working in a team for a project.
- Sharing ideas, solutions and thoughts.
- Developing creativity.

Subject (s):

Mathematics,
Engineering,
Technology,
Arts



Target audience: 13-16 age	Typology: Project work	Duration/Program: 60 min	
Materials: reusable materials (e.g., batteries, cans, paper, etc.)			
Activities and procedures			
<p>A.1. : Make research about the history of the robots and robotics in general. What types of robots are existing nowadays?</p> <p>A.2. : Make groups and define what type of robot you want to make, what are the main characteristics of it and why it is useful.</p> <p>A.3. : Find which are considered as reusable products and why they called like that.</p> <p>A.4. : Make the first design of your robot and make the necessary calculations.</p> <p>A.5. : Chose the appropriate materials for your robot, and explain why.</p> <p>A.6. : Make new research about similar types of robots that you will develop, and show them in the class.</p> <p>A.7. : Design the final version of your robot.</p> <p>A.8. : Develop your robot.</p> <p>A.9. : Testing your robot. Make corrections if it is necessary.</p> <p>A.10.: Presentation of your project.</p>			
Evaluation: Students learning how to cooperate, how to develop a project and how to present it.			

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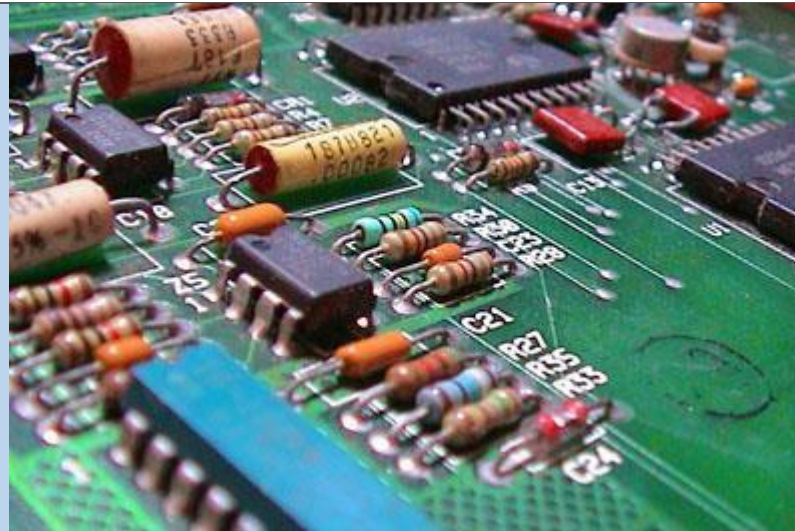
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Subject: Introduction to Python Programming

<p>Contents:</p> <p>Get to know more about programming and Python.</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Define what Python programming is and its application. ➤ Write simple Python programs using variables, data types and arithmetic operations. ➤ Develop programs to solve real-world problems using control flow statements. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Programming skills. ➤ Using of Python ➤ Teamwork 	<p>Subject (s):</p> <p>Technology, engineering</p>
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Target audience: 11-15 age	Typology: project activity	Duration/Program: 120 min	
Materials: Computer/ laptop, Python 3 IDE (Integrated Development Environment), Code editor (e.g., Visual Studio Code, Sublime Text, etc.), projector/ screen, worksheets.			
Activities and procedures			
<p>A.1.: Introduce the concept of programming and its importance in today’s world. Explain what Python is and why it is a popular programming language. Discuss the various applications of Python, such as data analysis, web development and artificial intelligence.</p> <p>A.2: Introduce the Python 3 IDE and explain how to create a new program.</p> <p>A.3. : Discuss basic syntax rules and data types in Python, such as strings, integers and floating-point numbers. Demonstrate how to create variables and assign values to them. Walk through simple arithmetic operations using Python.</p> <p>A.4. : Discuss the concept of control flow statements, such as if/else statements, loops and functions. Introduce the idea of conditional statements and demonstrate how to use if/else statements to control the flow of a program. Demonstrate how to use loops to perform repetitive tasks and provide examples of real-world applications of loops.</p> <p>A.5. : Provide students with a worksheet that contains problems requiring them to use control flow statements to solve real-world problems.</p> <p>A.6. : Introduce the concept of debugging and explain why it is an essential skill in programming. Demonstrate how to use the debugging tools in the IDE.</p> <p>A.7. : Ask students to identify and correct errors in a pre-written Python program.</p> <p>A.8. : Recap the key concepts and provide students with additional resources to continue learning Python programming.</p>			
<p>Evaluation: Students will be assessed based on their participation in class discussions, completion of the worksheet, and their ability to write Python programs to solve real-world problems using control flow statements.</p>			



Subject: Games with Scratch

Contents:

Games Design with Scratch

Goals:

- Discovering the beginnings of programming and robotics.
- Analyzing the evolution of programming and robotics valuing the most significant advances.
- Registration on the Scratch website and knowledge of the environment.
- Discovering block programming applied to video games.
- Recognizing the main basic programming structures.
- Analyzing the uses of repeat loops and conditional structures.
- Analyzing the uses of variables and their applications in the simplification of circuits.
- Design of a final video game.
- Final game development.

Skills:

- Learning about the history of robotics and programming.
- Knowing the uses of robotics.
- Understanding the importance of programming in today's world.
- Learning to work in a team.
- Learning to self-learn.
- Learning to program by blocks.
- Developing creativity.
- Designing and programming a video game in Scratch.

Subject (s):

Technology
Mathematics
Programming

Target audience: 12 – 13 age	Typology: Project work	Duration/Program: 120 min
<p>➤ Materials: Computers with internet connection.</p>		
<p>Activities and procedures</p>		
<p>Activity 1: Students will download and install the internship software.</p> <p>Activity 2: Make a study of the evolution of robotics and programming</p> <p>Activity 3: Make a study of the applications in current elements.</p> <p>Activity 4: With the help of a mentor learn the basic functions of the Scratch application. In groups of 3 students they will look for information on the internet to get the basic movements of the Sprite configured with the software.</p> <p>Activity 5: Explanation by the teacher the use of repeating and conditional loops. It will be done with different examples so that students acquire the necessary skills.</p> <p>Activity 6: Realization of a program in which you can create a story in Scratch with repetitive movements and a question and answer game. Students must self-learn thanks to the help of the internet and the mentor.</p> <p>Activity 7: Explanation by the teacher dthe use of variables. It will be done with different examples so that students acquire the necessary skills.</p> <p>Activity 8: Design and elaboration of the final product.</p> <p>Activity 9: Final video game programming</p>		
<p>Evaluation: Students learn how to create their own video games and how to continue learning autonomously.</p>		
<p>Know +: https://www.youtube.com/watch?v=NqMd44Oi2l4; https://scratch.mit.edu/;</p>		





Subject: Innovation in Business: The evolution of e-commerce in times of covid 19

<p>Contents:</p> <p>Getting to Know the importance of innovation in times of crisis.</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Reflect on the importance of innovation ➤ Discover specific themes and topics related to innovation and e-commerce ➤ Discover the different types of innovations: product and process as well as the differences between electronic commerce and retail. ➤ Discover the importance of innovation during covid 19: the e-commerce evolution. ➤ Analyze the evolution of spending on innovation by companies ➤ Analyze the evolution of the implementation of electronic commerce in Spanish and other European countries. ➤ Analyze the differences between retail and e-commerce. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learning about innovation. ➤ Understanding the importance of innovation, especially in times of crisis. ➤ Learning about the e-commerce, its advantages, effects and consequences. ➤ Discover the evolution of electronic commerce in Spain and other EU countries ➤ Know how to use different sources of information ➤ Learn to use spreadsheets like excel ➤ Learning to teamwork. ➤ Learning to use truthful bibliographic information. ➤ Learning to do oral presentations. 	<p>Subject (s):</p> <p>Business Statistics</p>
<p>Target audience: 15 age</p>	<p>Typology: Project work</p>	<p>Duration/Program: 60 min</p>	
<p>Materials: Computer devices with internet connection for each student group, Microsoft Excel (licenses will be given by the professor)</p>			

Activities and procedures

Activity 1: Before the lesson, students install the Microsoft Excel in their computers. The professor will teach the students how to use the spreadsheets. And to use of different files (.xls and .csv)

Activity 2: Students will search different sources of information. The objective will be to find data related to the evolution of innovation and e-commerce. Data from Spain and other EU countries will be used.

Activity 3: Students with the information (data) will prepare different graphs to analyze the evolution of spending on innovation as well as the development of electronic commerce vs retail trade. They will focus primarily on the years before and after the economic Covid-19 crisis.

Activity 4: Students will search for bibliographic information, previous studies that analyze these topics. The information obtained will be related to the data analyzed in the previous activity.

Activity 5: Students will elaborate a report of the entire project and they will do an oral presentation. A specialised jury will evaluate their work.

Evaluation: Students must learn to search for statistical data and bibliographic information which allows them to know the importance of innovation in sectors, such as commerce, and in times of crisis, such as covid 19.

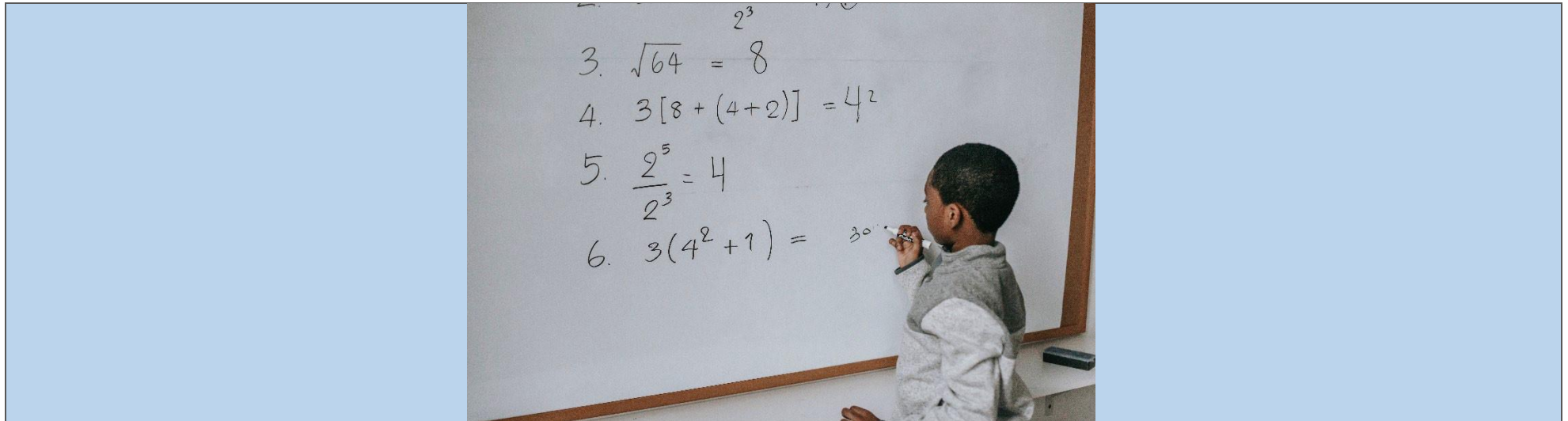
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Subject: Math Games & Puzzles

Contents:

Use problem solving in mathematics.
Use games in mathematics.

Goals:

- Students will be able to:
- Demonstrate an understanding of mathematical concepts and principles.
 - Use problem-solving skills to solve mathematical puzzles and games.
 - Collaborate with classmates to solve problems and complete tasks.

Skills:

- Teamwork.
- Communicational skills.
- Problem solving skills.
- Using imagination for mathematics.

Subject (s):

Mathematics, arts,

Target audience: 11-13 age	Typology: activity	Duration/Program: 120 min	
Materials: board games (e.g., chess, checkers, connect four, etc.), puzzles (e.g., sudoku, crossword puzzles, etc.), deck of cards, worksheets with math problems and puzzles, projector/screen.			
Activities and procedures			
<p>A.1. : Introduce the concept of math games and explain their importance in developing problem solving skills. Discuss how these games and puzzles can be used to reinforce and apply mathematical concepts.</p> <p>A.2. : Divide the class into groups and provide them with board games such as chess, checkers, connect four, etc.. Instruct students to play the games and focus on using strategic thinking and problem-solving skills to win.</p> <p>A.3. : After finishing the game, ask students to reflect on the strategies they used and how they applied mathematical concepts to win.</p> <p>A.4. : Provide students with puzzles (e.g., sudoku, crossword, etc.). Ask students to work individually or in pairs to solve the puzzle by using mathematical concepts such as logic, deduction and pattern recognition.</p> <p>A.5. : After the puzzle, ask students to share their strategies for solving them and how they used mathematical concepts to do so.</p> <p>A.6. : Provide students with a deck of cards and instruct them to play games that involve math concepts such as probability or mental math (e.g. of games: blackjack, 21, war, etc.).</p> <p>A.7. : After the game, ask students to reflect on the math concepts used during the game and how they applied them to win.</p> <p>A.8. : Provide students with worksheets that contain math problems and puzzles. Ask them to work individually or in pairs to solve problems and puzzles using mathematical concepts.</p> <p>A.9. : After the worksheets, ask students to share their strategies for solving the problems and how they applied mathematical concepts to do so.</p> <p>A.10.: Ask students to reflect on the lesson and how it has improved their problem-solving skills.</p>			
Evaluation: Students will be assessed based on their participation in class discussions, completion of the board games, puzzles, and worksheets, and their ability to apply mathematical concepts to solve problems and puzzles.			



Subject: Natural numbers

<p>Contents:</p> <ul style="list-style-type: none"> - Origin and evolution of numbers. - Additive numbering systems and positioning. - Structure of the decimal numbering system. - The big numbers: millions, billions, trillions... - Approximation of natural numbers by rounding. - Divisibility. 	<p>Goals:</p> <ol style="list-style-type: none"> 1. Knowing the different numbering systems. 2. Differentiating between additive and positional systems. 3. Knowing the structure of the decimal numbering system. 4. Approximating natural numbers to a given order of units. 5. Using the elementary calculator properly. 6. Simplifying and solving expressions with parentheses and combined operations. 7. Dealing with arithmetic problems with certainty and consistency. 8. Identifying divisibility relationships between natural numbers. 9. Differentiating prime and compound numbers. 10. Applying divisibility criteria to break down numbers into prime factors. 	<p>Skills:</p> <ol style="list-style-type: none"> 1. Identifying the mathematics involved in other subjects and in real situations likely to be addressed in mathematical terms, interrelating concepts and procedures to apply them in different situations. 2. Interpreting, modelling and solving problems of everyday life and of mathematics, applying different strategies and forms of reasoning, to explore different ways of proceeding and obtaining possible solutions. 3. Representing individually and collectively concepts, procedures, information and mathematical results, 	<p>Subject (s):</p> <p>Mathematics</p>
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<p>- Maximum. common divisor and minimum common multiple.</p>	<p>11. Master the procedures for calculating the maximum common divisor and minimum common multiple. 12. Be able to apply divisibility knowledge to solve problems.</p>	<p>by using different technologies to visualize ideas and structure mathematical processes.</p>	
<p>Target audience: 12 - 13 age</p>	<p>Typology: Tasks and exercises related to each of the contents to achieve objectives.</p>	<p>Duration/Program: 200 minutes</p>	
<p>Materials:</p>			
<ul style="list-style-type: none"> • Printed resources • Student book • Digital resources • Digital book • Resource bank in anayaeducacion.es. The following supporting materials can reinforce and expand the study of the contents of the Mathematics subject. • Resources and tools in the Diversity and Inclusion section. • Resources on the web. Web resources that allow students to reinforce or expand the contents of the unit by accessing different and attractive digital resources 			
<p>Activities and procedures</p>			
<p>Activity 1: Name the numbering systems you have studied.</p>			
<p>Activity 2: Write the numbers in the above systems: 5 and 19</p>			

Activity 3: Write with figures or letters, as appropriate:

- Three hundred and twenty-five million, four hundred thousand.
- Two billion, fifty-eight billion.
- 35 050 000 000

Activity 4: A beekeeper has 65 beehives with a yield of two harvests per year, at a rate of 9 kilos per hive in each harvest. Honey is packaged in jars of half a kilo and sold in boxes of 6 jars that are sold at 18 euros a box. What annual income does the apiary provide?

Activity 5: Define and give examples:

- Prime numbers
- Composite numbers

Activity 6: Indicates whether the numbers: 248, 32323, 8500 are divisible by

- 4
- 5
- 11

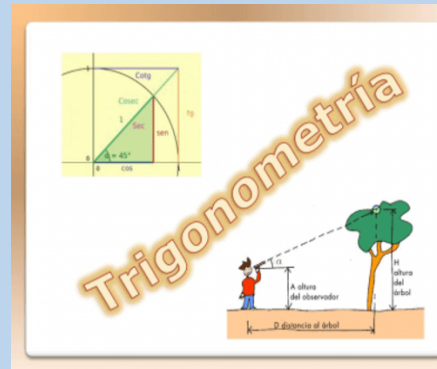
Activity 7: Calculate the maximum common divisor and minimum common multiple of numbers:

- 240, 375, 524
- 2400 and 77

Activity 8: Approximate by rounding to hundreds the number: 325 675

Evaluation: Cooperative structures: 1-2-4 and rotating sheet.

Know +: Students will investigate the evolution of numbering systems and numerical sets as well as their use in different countries from antiquity to the present.



Subject: MEASUREMENTS IN RIGHT TRIANGLES

<p>Contents:</p> <ul style="list-style-type: none"> • Trigonometric ratios of an acute angle. • Resolution of right triangles. • Resolution of nonrectangle triangles: height strategy. 	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Defining and calculating the trigonometric ratios of an acute angle. ➤ Using the calculator functions to get the reasons for an angle and vice versa. ➤ Solving right triangles. ➤ Using trigonometry to solve geometric and real-life problems. 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Developing social skills of cooperation and teamwork. ➤ Using concepts and relationships of basic trigonometry to solve problems employing technological means, if necessary, to perform calculations. ➤ Using the appropriate technological tools, strategies and formulas to calculate angles and lengths of bodies and geometric figures. ➤ Solving triangles using trigonometric ratios and their relationships. 	<p>Subject (s):</p> <p>Mathematics</p>
<p>Target audience: 16 years</p>	<p>Typology: Task</p>	<p>Duration/Program: 100 minutes</p>	

Materials: Geogebra. Scientific calculator.

Activities and procedures



Activity 1: Being given a triangle, express the trigonometric ratios of the angle α indicated in the figure.

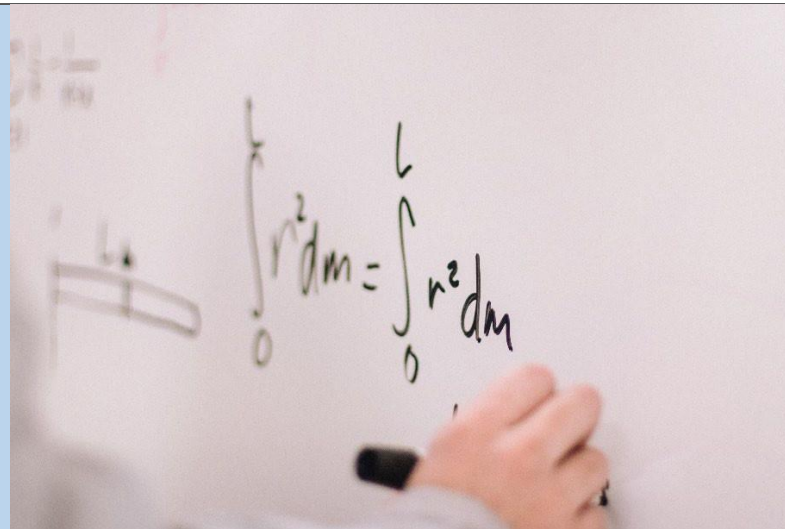
Activity 2: Being given one side and one angle, or being given two sides in a right triangle calculate the other missing elements.

Activity 3: Determination of heights and distances that cannot be measured directly.

Activity 4: Use the height strategy in non-right triangles.

Evaluation: Students will be able to solve any geometric problem in which a right triangle is present.

Know +: <https://teodolito.top/>; <https://phet.colorado.edu/es/simulations/trig-tour>; <https://www.geogebra.org/m/MTtNVSxG>



Subject: Design Thinking

Contents:

Learning how to make research.
Observing facts and numbers.
Learning how to do an interview and conclude its results.

Goals:

- Learning how to make an interview step by step.
- Prioritize the information and get results for research.
- Define a specific problem for an existing situation.
- Use of applications, software and technology for research.
- Exercising on Design Thinking Methodology.
- Technology: explains how it affects individuals, societies, cultures, economies and the environment.
- Learn about causes in the environment.

Skills:

- Organizational and communicational skills.
- Working in groups.
- Sharing ideas and results.
- Define the important information and conclude into a main problem.
- Take part in research.

Subject (s):

Technology,
Engineering,
Mathematics,
Science

Target audience: 13-16 age	Typology: Project work	Duration/Program: 120 min	
Materials:			
Activities and procedures			
<p>A.1. : Make research about technology: how it is affecting our life, its use and its progress.</p> <p>A.2. : Learn about the interview's structure, main characteristics and how it is an effective interview.</p> <p>A.3. : Prepare an interview and practice it, collect information from people using your interview.</p> <p>A.4. : Take notes of mistakes or good examples you saw and correct your interview.</p> <p>A.5. : Take the results from your interview, form them into groups and present them by using technology and applications.</p> <p>A.6. : Learn about Design Thinking Methodology.</p> <p>A.7. : Make research on internet about a problem that you believe needs to be solved in your country/society.</p> <p>A.8. : Use the Design Thinking Methodology in order to find a solution in this problem.</p> <p>A.9. : Present your solution with arguments and ask for feedback.</p>			
Evaluation: Students learn how to use interviews and Design thinking methodology in order to find a solution in a problem. Also, they learn the importance of technology.			



Subject: Investment management

<p>Contents: Getting to Know the Investment management</p>	<p>Goals:</p> <ul style="list-style-type: none"> ➤ Discover specific themes and topics related to Investment in renewable energy ➤ Discover specific themes and topics related to Cash flow ➤ Discover specific themes and topics related to cost of capital. ➤ Discover specific themes and topics related to financial statements. ➤ Discover the role of amortizations. ➤ Calculate the cost of the capital. ➤ Calculate the return on assets (ROA). ➤ Calculate the return on equity (ROE). ➤ Calculate the Cash flow . ➤ Calculate the Net Present Value. (NPV) ➤ Calculate the internal Rate of Return (IRR). 	<p>Skills:</p> <ul style="list-style-type: none"> ➤ Learning about the Investments ➤ Learning about the use of a spreadsheet. ➤ Understanding the way of calculating the Cost of capital, ROA, ROE, Cash Flow, NPV and IRR. ➤ Learning if a project is viable and to measure its profitability. ➤ Learning to teamwork. ➤ Learning to use truthful bibliographic information. ➤ Learning to do oral presentations. 	<p>Subject (s): Technology Investment Finance</p>
<p>Target audience: 15 age</p>	<p>Typology: Project work</p>	<p>Duration/Program: 60 min</p>	
<p>Materials: Computer devices with internet connection for each student group, Microsoft Excel (licenses will be given by the professor)</p>			

Activities and procedures

Activity 1: Before the lesson, students install Microsoft Excel on their computers. The teacher sends the spreadsheet template to the students.

Activity 2: Students select what type of renewable energy they want to make their investment project on.

Activity 3: Students prepare an investment budget for their project and estimate its useful life.

Activity 4: Students create an income and expense account for their project for each year of its useful life.

Activity 5: Students prepare interim financial statements for the years of their project's useful life.

Activity 6: Students estimate the estimated generated cash flow for each year of its useful life.

Activity 7: Students will calculate the cost of capital used to finance their project.

Activity 8: Students will calculate the ROE, ROA, VPN, IRR of their project and will give their opinion on its viability.

Activity 9: The students will prepare a report of the entire project and will make an oral presentation. A specialized jury will evaluate your work.

Evaluation: The student discovers what an investment project in renewable energies consists of, what are the key variables that affect its viability and how its profitability is measured.

Know +:

The Partnership



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DEL CARMEN (BETANZOS)



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