



The Journey of the Drop: STEAM Hydrological Cycle

Cycle: 2nd of Primary School **Year:** 4^o

Curricular Areas: Natural Sciences (Focus: Technology and Digitalisation), Art Education.

Timing: 2nd term

Number of sessions: 5 sessions



Introduction

How can we see and understand the constant journey of a drop of water across our planet? The hydrological cycle is a vital and continuous process. In this Learning Situation, Year 4 Primary students will face the challenge of building an interactive model that visualises five key phases of the water cycle. To do this, they will use recycled materials (in line with the SDGs and caring for the environment) and integrate components from the Art2bit robotics kit.

The project requires integrating creativity in the visual arts with technology and engineering. The final product will be a model in which a representation of a drop moves 180 degrees with five stops (one per phase) using a servomotor. At each stop, a specific LED will light up and the micro:bit board matrix will display the name of the phase. Students will develop computational thinking skills (block programming in MakeCode) and project design skills (Art2bit's C.R.E.A. method).



Teaching Guide

Primary School Curriculum in the Community of Madrid (Decree 61/2022), RD 157/2022 (minimum teaching requirements) and Order 130/2023 (assessment and organisation)



General Objectives for the Stage

- b) Develop individual and team work habits, effort and responsibility in study, as well as attitudes of self-confidence, critical thinking, personal initiative, curiosity, interest and creativity in learning, and entrepreneurial spirit.
- h) To learn about the fundamental aspects of Natural Sciences.
- i) Develop basic technological skills and begin to use them for learning, developing a critical spirit regarding their functioning and the messages they receive and produce.
- j) Use different artistic representations and expressions and begin to construct visual and audiovisual proposals.



Specific Goals

- Understand and explain the five fundamental phases of the water cycle.
- Design and build a model of the water cycle using recycled materials, applying



creativity and the visual arts (A in STEAM).

- Integrate and connect the micro:bit board, a servomotor and five LEDs in the physical prototype.
- Develop an algorithm using block programming (MakeCode) to automate the movement of the drop and the visualisation of the phase on the micro:bit.
- Communicate and discuss the design and programming process, justifying the technological solutions chosen.
- Raise awareness about the responsible use of natural resources, such as water.

Specific Competence	Assessment Criteria	Key Core Subject
<p>Natural sciences CE 3: Solve problems through design projects and the application of computational thinking, creating new products according to needs.</p>	<p>3.1 Work as a team to build a simple final product that solves a problem of need, use and design, proposing possible solutions, testing different prototypes and safely using the appropriate tools, techniques and materials. 3.3 Solve simple programming problems with guidance, checking whether the answer fits the purpose, modifying algorithms according to the basic principles of computational thinking.</p>	<p>Block B: Technology and digitalisation. Design and computational thinking projects: Introduction to programming through block programming applications, educational robotics. Phases of design projects: design, prototyping, testing and communication.</p>
<p>Natural sciences CE 6: Identify the causes and consequences of human intervention in the environment... to improve the ability to face problems, seek solutions and act to resolve them, promoting respect, care and protection for people and the planet.</p>	<p>6.2 Learn about and demonstrate appropriate lifestyle habits, with respect, care and protection for the planet, identifying the relationship between people's lives and their actions on the elements and resources of the environment.</p>	<p>Block A: Scientific culture. Examples of good and bad uses of our planet's natural resources and their consequences.</p>



Learning situation



Technology and robotics

CE 2: Solve problems by applying knowledge of mechanics, electricity, design and programming, developing automated solutions...

2.1 Apply basic knowledge of electricity and mechanics to assemble devices. **2.2** Guided by a teacher, create a simple final product that solves a design problem, testing different prototypes as a team and using mechanical, electrical or programming materials safely.

Block C: Electricity.

Basic electricity and electronics: cables and connectors, actuators (servos), circuits, sensors, motors, batteries.

Artistic education

CE 4: Participate in the design, development and dissemination of individual or collective cultural and artistic productions, taking into account the process and assuming different roles....

4.2 Participate in the process of cultural and artistic productions, in a creative and respectful manner, using basic elements of different artistic languages and techniques.

Block II: Plastic and

Visual Education. Two-dimensional and three-dimensional techniques in simple drawings and modelling. Stages of the creative process: planning, interpretation and experimentation.



Methodology

The methodology will be based on **Cooperative Learning** and **Project-Based Learning (PBL)**, following Art2bit's **STEAM** approach, which integrates the visual arts (A) with technology. The **C.R.E.A.** method will be applied:

- 1. Connect:** The project is connected to the challenges of water scarcity (SDG 2030).
- 2. Track:** Research the phases of the water cycle and the technological components (micro:bit, servo, LEDs).
- 3. Experiment and Create:** Construction of the model and coding of the prototype, applying block programming logic (MakeCode).
- 4. Analyse:** Evaluation, self-assessment and communication of project results.



Grouping

Throughout this learning situation, activities are proposed with different types of grouping:

Small group: groups of 3 to 6 students work together on specific projects or tasks. Facilitates communication, cooperation and the development of social skills.

Class group: the whole class participates in a joint activity, such as discussions or reflections. This encourages participation and critical thinking.



Space

The following spaces are used in this learning situation:

- Classroom (for research, planning and programming in MakeCode).
- Workshop/Art/Technology Corner (for model construction and assembly of Art2bit components).
- Exhibition corner (for the final presentation).



Resources

Human	Material	Digital
<p>Teachers: teachers and instructors who guide and facilitate learning.</p> <p>Students: Classmates who collaborate and learn together.</p> <p>Family members:</p>	<p>Art2bit Kit (1 per group): Micro:bit v2 board, Jovi Extension Board, 1 0-180 rotation servomotor, 5 coloured LEDs. Office supplies, cardboard, glue, scissors, recycled materials (bottles, cardboard, etc.), pencils,</p>	<p>Programming environment Microsoft MakeCode (block-based programming). ART2BIT educational platform (guides, videos, resources). Interactive</p>



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parents and guardians who support learning at home.

External experts: guest professionals who contribute specific knowledge on a topic.

pens, paper, scissors, glue, etc.

whiteboard/projector.

Online resources on the water cycle



Assessment

In order to properly assess the learning situation, procedures, assessment activities and tools have been established that accurately reflect the objectives and competencies set out. Assessment not only measures students' progress and achievements, but also provides valuable information for adjusting and improving the teaching process. These aspects are detailed below.

Procedures	Assessment activities/products	Assessment Tools
Direct observation Oral exchanges Student work Self-assessment Peer assessment	Participation in explaining the water cycle. Physical model and correct placement of components. Digital programming file. Presentation and defence of the project. Co-evaluation between groups	Rubrics (to evaluate prototype, process, and presentation). Checklists (to verify connections and code elements). Self-assessment target Peer assessment rubric. Class diary (record of process/roles)



Teacher's Assessment

Observable items: the teacher establishes observable indicators of the activity to carry out an active analysis of the dynamics generated in the classroom:

- Carries out the programme correctly
- Explains the programme adequately
- Uses the material appropriately and correctly
- Builds the model correctly
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Assessment rubric for the teacher ([downloadable document](#))

	Excellent	Satisfactory	Improvable	Need to improve
Scientific Content and Sustainability	Accurately explains and discusses the five phases of the hydrological cycle , using appropriate vocabulary and establishing a clear connection with the responsible use of water .	Correctly explains the five phases of the water cycle and mentions the importance of protecting natural resources.	Names the main phases, but the explanation is partial or includes some conceptual inaccuracies. Does not delve into environmental awareness.	Shows significant confusion about the order or content of the phases. The scientific concept is incomplete.
2. Programming and Functionality of the Prototype	The code is efficient, clear, and functional . The prototype fulfils the objective in a stable manner: it performs the 5 stops (0° to 180°), correctly activates the 5 LEDs, and the micro:bit displays the text for each stage.	The hardware connections and code are basically correct. The prototype works, but has minor flaws or the MakeCode logic could be clearer or more efficient.	The prototype fulfils the main function (movement and LEDs), but requires frequent assistance to correct connection errors (servomotor/LEDs) or code	The connections are incorrect, the code is incomplete, or the prototype is not functional. There is no evidence of debugging.



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	Demonstrates the application of ' ' <i>debugging</i> .		logic.	
3. Physical Design and Aesthetics (Art/Engineering)	The model is creative and well finished . It uses recycled materials and the physical assembly of the mechanism and components (servo, LEDs) is correct, safe and robust.	The model is functional and complies with the design. The hardware assembly (servomotor and LEDs) is correct, although the aesthetics or use of recycled materials is simple.	The design of the model is simple or unpolished. The assembly of the hardware is unstable or required constant supervision to ensure connections.	There is no planned design. The prototype is incomplete or the hardware is not integrated into the model in a safe or functional manner.
4. Process, Collaboration and Communication	The team plans the work and distributes roles (artist, programmer, etc.) equitably and collaboratively. The presentation is clear, orderly, and justifies the technological solutions . The group documents the process (analysing the C.R.E.A. method).	There is task distribution and collaboration. The presentation is understandable and includes a demonstration of the prototype and explains the basic functioning of the code.	The distribution of roles is uneven; collaboration is minimal or there were conflicts that interrupted the work. The presentation is partial, disordered or lacks technological justification.	Lack of coordination and fulfilment of roles. The presentation is confusing, the prototype is not demonstrated, and the team is unable to explain the design and programming process.



Student's Assessment

Individual self-assessment of the session: [Downloadable document](#)
Co-evaluation by the students in the group: [Downloadable document](#)



Activities

Session No.	1
Duration	45 minutes
Type of Activity	Class group / Small group
Description	Explanation of the Water Cycle and Connect (C.R.E.A.) The teacher explains the phases of the water cycle (evaporation, condensation, precipitation, infiltration and collection), emphasising the importance of water (SDG) and the need for models to understand complex systems. The micro:bit board and Art2bit components (servo, LEDs) are introduced as tools for creating a dynamic model. The five phases are explored in depth.
Resources	- Visual resources/videos on the water cycle. https://www.youtube.com/watch?v=x-Em4JGD8pQ - Micro:bit demonstration.

Session No.	2
Duration	45 minutes
Type of Activity	Small group



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Description	Prototype Design and Tracking (C.R.E.A.) explains how the model will be constructed (e.g., a cardboard/box background representing the earth and sky) and the 180° movement mechanism for the drop. Cooperative groups (4 students) are formed and roles (rotating) are assigned. The group plans the design of the model (recycled materials) and establishes the work plan for assembly, defining the 5 positions/stops and where each LED and servomotor will go.
Resources	- Office supplies. - Design/role planning sheet. Downloadable document

Session No.	3
Timing	45 minutes
Type of activity	Small group
Description	Construction, Hardware Integration and Experimentation (C.R.E.A.) The teams build the base of the model using recycled materials and assemble the servomotor mechanism. They connect the micro:bit, the servomotor (P1) and the 5 LEDs (P0, P2, P8, P9, P10) to the Art2bit extension board, following the connection diagram and paying attention to the polarity of the LEDs. An initial manual test of the mechanism is carried out to ensure that the drop moves 180 degrees without obstruction.
Resources	- Art2bit kit (Micro:bit, Servo, 5 LEDs). - Recycled materials, glue, scissors. - Connection diagram and connection table. Downloadable document . - Program. Downloadable document .

Session No.	4
Duration	45 minutes
Type of activity	Small group



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Description	Movement Programming and Analysis (C.R.E.A.) Students access Microsoft MakeCode. The teacher guides the programming of the algorithm. The code must: 1) Initialise the servo to 0 degrees. 2) Create a function or loop to go through the 5 phases (0°, 45°, 90°, 135°, 180°). 3) At each stop, the code must turn off the previous LED, turn on the current LED, and display the name of the phase on the micro:bit LED matrix. The code is uploaded to the micro:bit and testing (trial and error) is carried out. The teams record the tests and debug the code.
Resources	- Computers/Tablets. MakeCode environment. - Debugging test log. Downloadable document .

Session No.	5
Duration	45 minutes
Type of activity	Small group/class group
Description	Presentation, evaluation and conclusion. The groups present their models to the class, explaining the water cycle, how the prototype works and the code implemented. An assessment, peer assessment and self-assessment session is held using simple rubrics and targets to assess both knowledge of the cycle and programming and teamwork skills.
Resources	- Models and functional prototypes. - Rubrics and assessment sheets. Downloadable document .



Cater for diversity

As a teacher committed to the inclusion and success of all students, it is essential to adapt tasks and activities to address diversity in the classroom. Following the principles of **Universal Design for Learning (UDL)**, flexible and personalised strategies can be implemented that respond to the individual needs of each student.

Below are the guidelines and measures that will be applied to promote an inclusive and effective learning environment:

- **Reinforcement and flexibility of requirements:** For students who need to consolidate concepts, the requirements in the programme can be adjusted, focusing only on the sequence of movements and the lighting of the LEDs (without the text matrix), or asking them to explain only the main parts of the water cycle.
- **Grouping and roles:** Cooperative group work with defined roles will be promoted, ensuring that each member contributes according to their strengths (for example, students with greater artistic skills focus on the aesthetics of the model, while others focus on the code or documentation).
- **Multiple Means of Expression:** In the final exhibition, students can choose whether to focus their presentation on oral explanation (Spokesperson), practical demonstration of the code (Programmer), or visual presentation of the model (Designer).
- **Visual/digital support:** MakeCode, a graphical block-based programming tool, will be used, which makes it easier for all levels to understand the logic. The Art2bit platform also provides videos and step-by-step guides for ongoing support.