

Teacher Guide for Ireland

Developed by the DCU Institute of Education

FIRST® LEGO® League Explore

Presenting: BIOGLOW™

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Welcome to the *FIRST*® LEGO® League Explore BIOGLOW™ Teacher Guide for Ireland

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This guide has been developed by a leading team from the DCU Institute of Education to support teachers across Ireland to engage with *FIRST*® LEGO® League Explore within their classrooms.

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Creative Hut

Since 2010 Creative Hut, formerly Learnit, has been on a mission to 'inspire the creators of tomorrow by making learning fun for the learners of today'. We are the delivery partners for *FIRST*® LEGO® League in Ireland. We are proud to partner with *FIRST*® and DCU to bring STEM to life through this hands-on, minds-on approach to learning.



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Welcome to the BIOGLOW™ Teacher Guide

Biodiversity is the focus of this year's *FIRST*® LEGO® League Explore season. Through the BIOGLOW™ challenge, learners will explore biodiversity, build creatures, and discover how plants and animals work together to support healthy ecosystems. Teams are encouraged to explore the rich natural heritage of Ireland before examining the global canopy of the rainforest. While investigating the treetops like wildlife biologists, learners will also discover that biodiversity is a key indicator of our planet's health, and by taking inspiration from the natural world, they will use STEM, teamwork, and creativity to help build a healthier, more connected planet.

This BIOGLOW Teacher Guide aims to support Irish primary school teachers by illustrating how the programme aligns with the Irish Primary School Curriculum. Grappling with authentic real-world issues, such as Ireland's current biodiversity crisis, learners develop knowledge and skills as they design, build, and code unique solutions powered by LEGO Education SPIKE™ Essential. From the "living classrooms" of our school grounds to native habitats like hedgerows, ponds and peat bogs, BIOGLOW is embedded throughout the curriculum, achieving curriculum objectives, skills, and competencies in a holistic and integrated manner.

This Teacher Guide is organised into two parts:

- **Part A** provides a background to *FIRST* LEGO League Explore BIOGLOW, offering an overview of the Irish Primary Curriculum and policy connections alongside support for teachers.
- **Part B** is a detailed overview of the twelve classroom sessions.

Throughout these sessions learners will not only build tools to study biodiversity, but also learn to identify and protect native Irish species. They will explore the importance of insects and pollinators in our food webs and could even contribute to citizen science by recording sightings with the National Biodiversity Data Centre. Finally, teams will participate in a Celebration Event to share their projects with reviewers, families, and friends.

Learning activities in this Teacher Guide are specifically designed with plenty of scope for differentiation so the sessions can be adapted to suit each participating class. Resources required, details of coding, teacher support, and guiding questions are provided for each session. It is important to note that each session has core curriculum links that are necessary for the learners to learn about biodiversity and computational thinking. Extension activities which link across the curriculum and support the development of the learners' knowledge and skills are presented, thereby enhancing their understanding of this real-world context and achieving the aims of the curriculum simultaneously.

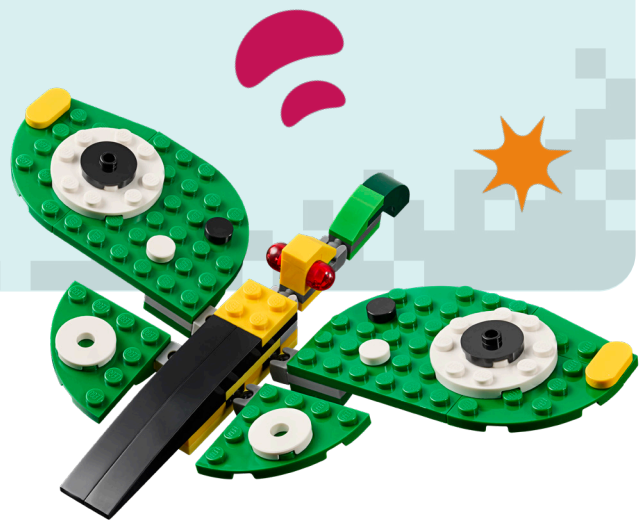
Engagement with the 12 sessions of the BIOGLOW Teacher Guide for Ireland will involve approximately 15 hours of class time.



What is *FIRST* LEGO League Explore?

FIRST LEGO League Explore is a non-competitive, hands-on programme geared towards primary school aged learners from 2nd class (aged 7-8) to 6th class (aged 11-12). The programme aims to inspire learners to experiment and grow their confidence, critical thinking, and design skills through meaningful, hands-on learning activities. Each year *FIRST* LEGO League Explore focuses on a relevant, real-world theme with this year's challenge called BIOGLOW. Learners work together in teams using elements from a LEGO Education Set (SPIKE Essential) and a BIOGLOW Explore Set to build a Team Model which shares what they have learned about biodiversity and healthy ecosystems, and demonstrates an understanding of the work of scientists and the technology used to study and protect nature.

This BIOGLOW Teacher Guide has been designed to provide learners with authentic and meaningful Curriculum Connections. The sessions in this Teacher Guide have been intentionally laid out so that learners develop their knowledge, understanding and skills in advance of designing and building their Team Models and accompanying posters in session 10, preparing to present at a Showcase Event in session 11, and reflecting upon their learning journey in session 12. Figure 1 provides an overview of BIOGLOW sessions 1-12.



Sessions 1-9	Context and knowledge	Developing familiarity and understanding of knowledge, skills and concepts including biodiversity, computational thinking and coding
Session 10	Team Model and Poster	Building and coding Team Model Creating Team Poster
Sessions 11-12	Showcase Event Reflecting on the BIOGLOW experience	Sharing what the team have learned during the Showcase Event and reflecting on their BIOGLOW learning journey

Figure 1. BIOGLOW Sessions 1-12

Core Values of *FIRST* LEGO League

FIRST LEGO League Explore is underpinned by the six *FIRST* Core Values that are the cornerstones of the programme. *FIRST* LEGO League envisions that through the Core Values, learners use discovery and exploration in each session and learn that helping one another is the foundation of teamwork.

Throughout each session it is important that the learners have fun and are motivated. You will find references to the six Core Values (see Table 1 below) throughout each of the sessions. You can take time to emphasise the Core Value when you see the symbol.



The Core Values have strong connections to the Irish SPHE curriculum:

Subject	Strands	Strand Units/Elements	Skills and Concepts
SPHE	Myself and others Myself and the wider world	My friends and other people Relating to others Developing citizenship	Communication skills Working collaboratively and co-operatively with others Personal and self management skills Confidence and competence using language Decision-making skills

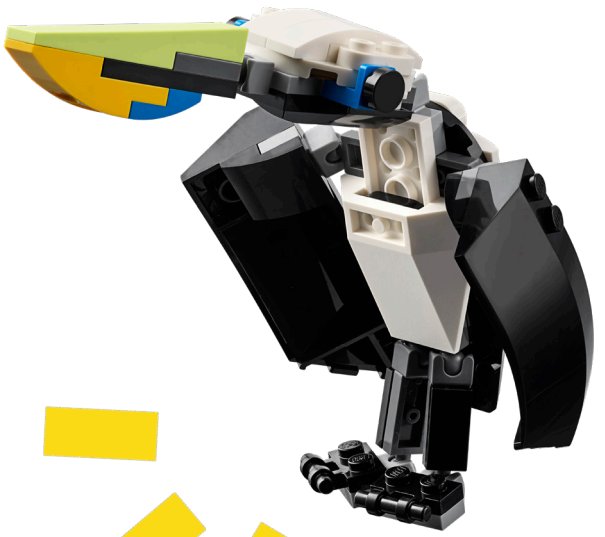
Table 1. Irish SPHE curriculum

Core Value	Description	Alignment with Primary Wellbeing Specification (2025)	Alignment with 1999 SPHE Curriculum
	We are stronger when we work together.	Aligns with Emotional and Relational Education, specifically building healthy relationships with teammates. The element of Communicating emphasises collaborating and cooperating.	Aligns with Myself and others (My friends and other people; Relating to others). It develops skills in co-operation, communication, and working collaboratively in groups.
	We respect each other and embrace our differences.	Directly reflects Community and Belonging, which encourages learners to respect diversity and foster fairness. Supports challenging stereotypes and prejudice.	Aligns with Myself and others (Relating to others) and Myself and the wider world (Developing citizenship). It promotes respect for diversity and being inclusive of others.
	We apply what we learn to improve our world.	Aligns with Being an Active Citizen, empowering learners to take positive actions to live sustainably and address local or broader concerns.	Aligns with Myself and the Wider World (Developing citizenship; Environmental care). Focuses on social responsibility, active citizenship, and caring for the environment.
	We use creativity and persistence to solve problems.	Reflected in Exploring and Applying, which nurtures curiosity and adaptability. Aims to build "confidence to persevere" with appropriate challenges.	Aligns with Myself (Self-identity) and Making decisions. It develops self-confidence and the ability to solve problems by choosing appropriate actions.
	We explore new skills and ideas.	Matches the Active Learner competency, where learners engage in "hands-on and minds-on" exploration to deepen understanding of the world.	Aligns with Myself (Self-awareness) and Myself and the wider world (Media education). Learners learn to receive information from many sources to explore their environment.
	We enjoy and celebrate what we do!	A core principle stating learning should be enjoyable and fun, helping learners to realise their potential and foster positive attitudes.	Aligns with promoting personal development and well-being through a positive school climate. Nurtures self-worth and a sense of belonging.

Table 2. Core Values of FIRST LEGO League

The investigative, problem-based structure of the BIOGLOW challenge enables learners to develop as Active Citizens while fostering Wellbeing through meaningful collaboration.

Biodiversity and Curriculum Connections



Biodiversity is the variety of all life on earth and the ecosystems where they live. By breaking down the term, “bio” refers to life and “living things” while “diversity” signifies range or variety, highlighting that a more diverse environment is healthier, more resilient and benefits more living things. All living things on our planet are inter-connected and inter-dependent. As humans we depend on biodiversity for our survival, through all of the essential functions it provides us with.

The role of the teacher in the BIOGLOW™ challenge is to act as a facilitator of learning and as an instigator for environmental awareness and action. Participating in the BIOGLOW challenge can inspire everyone to protect their natural heritage. By creating a “living classroom” environment and engaging in outdoor learning, teachers empower students to recognise the intrinsic value of nature and take proactive roles as informed protectors of the planet.

Biodiversity and the Primary Curriculum Framework

The 2023 Primary Curriculum Framework embeds biodiversity as a central theme for developing future-ready skills through seven key competencies. Learners act as Active Citizens (AC) when they participate in conservation efforts and recognise the value of local flora and fauna, while they become Active Learners (AL) by inquiring into how ecosystems flourish. The Creative (C) and Digital Learner (DL) competencies are used by learners while they design and motorise LEGO prototypes to address problems and use technology to simulate scientific monitoring. Furthermore, teams apply Mathematical (M) skills through habitat mapping, recording and communicating data, and they develop as Communicators (CL) by documenting their journey. The competency of Being Well (W) encourages a meaningful connection with nature and the outdoors.

Depending on the order a school has chosen to roll out the five curriculum areas from September 2026, a school may be referring to the 1999 curriculum or the 2025 Primary Curriculum while engaging with BIOGLOW.



Biodiversity and the 1999 Curriculum

The BIOGLOW theme aligns directly with the core strands and objectives of the 1999 Primary School Curriculum, providing a framework for authentic scientific and geographical inquiry. Within Science, biodiversity is primarily explored through the Living Things strand, focusing on the interdependence of plants and animals, and the Environmental Awareness and Care strand. In Geography, the theme is supported by the Natural Environments strand, which allows for the comparative study of local Irish habitats, such as native hedgerows and bogs, alongside global climatic regions like the tropical rainforest. Through these integrated subjects, learners develop fundamental investigation skills, including questioning, observing, and recording the natural world, while learning to identify common species and understand how they adapt to their environments.

Biodiversity and the 2025 Primary Curriculum

The redeveloped curriculum specifications provide specific learning outcomes that BIOGLOW directly addresses through an integrated approach. The Social and Environmental Education (SEE) Specification focuses on biodiversity within the Environment and Sustainable Living strand, enabling learners to investigate physical features like rivers and hedgerows and identify opportunities to protect them. This is complemented by the Science, Technology, Engineering and Mathematics (STE and Maths) Specification, which emphasises scientific inquiry and the design thinking process through the Living Things strand. Teachers are encouraged to use "teachable moments" to deepen disciplinary knowledge as learners explore interdependence and investigate how science and engineering can solve biodiversity-related problems locally and nationally.



Learning principles behind BIOGLOW

The BIOGLOW™ challenge is underpinned by an integrated approach to STEM (Science, Technology, Engineering, and Mathematics) education, which allows learners to connect their learning across disciplines and apply it to real-world environmental contexts. This approach aligns the engineering design process and inquiry-based learning with the Phases of Integrated STEM Learning as defined in the STEM Education Specification (2025). These learning principles guide learners as they work toward the final goal of creating their Team Model and Team Poster.

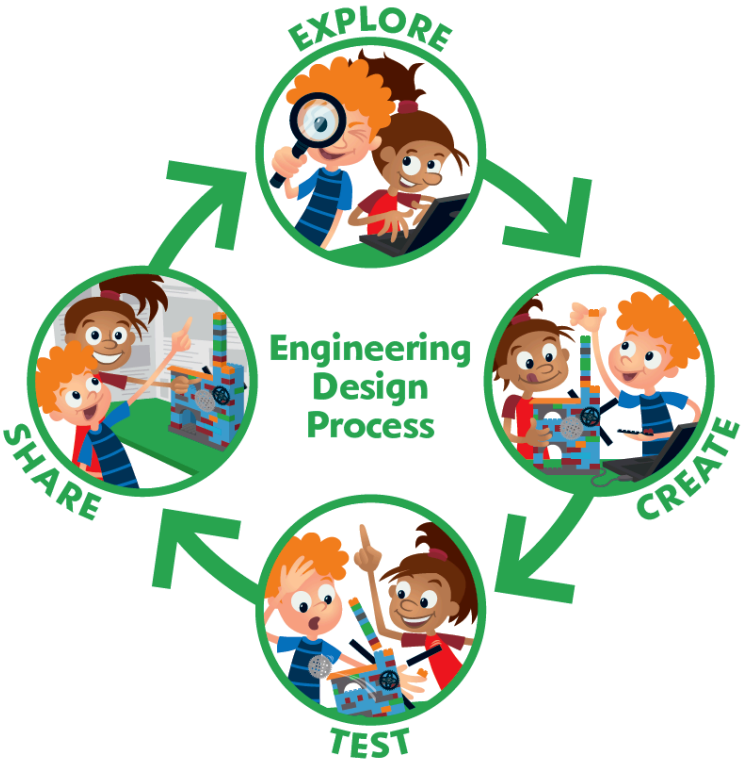


Figure 2. Engineering Design Process

The Engineering Design Process

The Engineering Design Process underpins the BIOGLOW challenge, see Figure 2. Here, learners are encouraged to work like real engineers, using scientific, geographical and mathematical skills and understanding to investigate and think critically about real-world problems and propose creative solutions.

The Engineering Design Process has four stages: Explore a problem; Create one or more solution(s); Test the solution(s); Share with others what you have learned. There is no fixed order for this process. Learners may go through some or all parts several times throughout the sessions.

Enquiry-based Learning

These four stages of the Engineering Design Process align with the stages of enquiry-based learning, particularly for both science and geography.

The enquiry-based learning process comprises a child-centred, experiential, constructivist approach whereby learners are active in their learning

and participate in the leading of investigations through posing questions and generating ideas before actively creating and collecting data to help develop their understanding. These teaching and learning approaches are advocated throughout the Irish Primary School Curriculum. Enquiry-based learning begins with a problem or obstacle to a learner's development; they analyse the situation; they identify possible solutions; they compare the implications of the different solutions and select the best course of action; they implement this in practice. Roberts' (2013) Framework for Enquiry (Figure 3) is an example of an enquiry-based learning process for teaching and learning in geography and science. As outlined below it has explicit correlations with the Engineering Design Process.

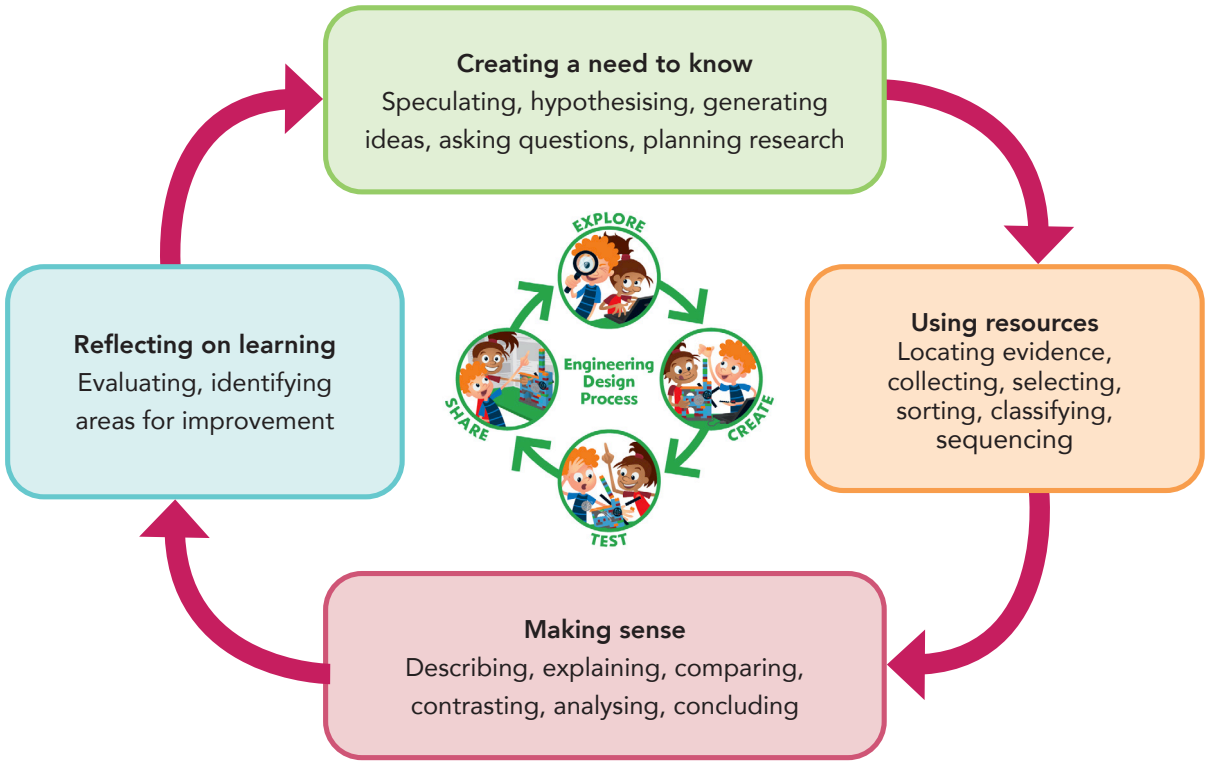


Figure 3. Enquiry-based learning framework (Roberts, 2013)

The Explore stage of the Engineering Design Process is directly aligned with the Creating a Need to Know stage of the enquiry framework. Here, the learners are introduced to the problem or scenario through a stimulus. This involves the learners hypothesising, speculating and generating ideas and questions for investigation drawing on their existing knowledge and everyday experiences. The Create stage of the Engineering Design Process is connected to the Using Resources stage of the enquiry framework. This involves the learners actively carrying out investigations on the issue at hand. Here they use a range of resources to both create and collect data to be used as evidence for their investigations. In both the Test stage of the Engineering Design Process and the Making Sense stage of the enquiry process, the learners analyse and interpret the data pertaining to their investigations, thus reflecting on and modifying their ideas and concepts and developing specific recommendations and solutions for issues. Finally, similar to the Reflecting on Learning stage in the enquiry process, the Share stage of the Engineering Design Process culminates in the learners presenting their work, reflecting on what they learned, and identifying areas where they were successful and areas in need of improvement. The Engineering Design Process underpins many of the sessions in BIOGLOW, and is first seen in Sessions 2 & 3.

Integrated STEM Learning

The STEM Education Specification advocates for learners to engage in integrated STEM learning. Integrated learning experiences provide an opportunity for dedicated time and space for learners to engage in integrated STEM and opportunities where they can apply, reinforce and consolidate the knowledge and skills they have acquired from their learning.

The BIOGLOW™ challenge aligns the engineering design process with the Phases of Integrated STEM Learning as defined in the STEM Education Specification. These five flexible phases guide learners as they work toward the final goal of the Team Model and Poster.

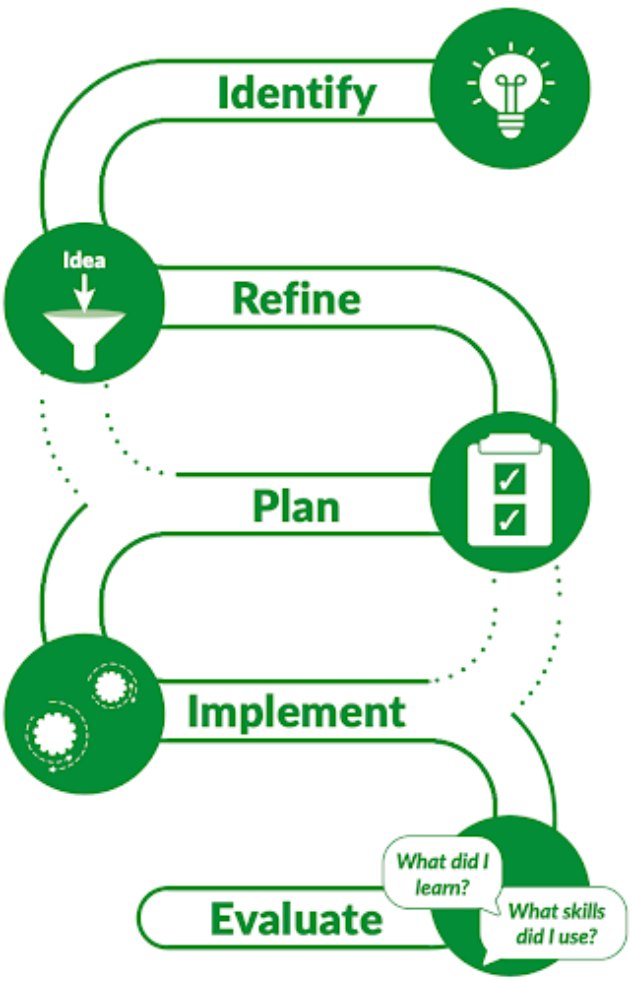


Figure 4. Phases of Integrated STEM Learning (Department of Education and Youth, 2025)



Phase 1: Identify

Integrated STEM learning begins with the learners own interests and wonderings, which spark a meaningful, child-led task. During the early BIOGLOW sessions, learners develop their "STEM eyes" to explore the concept of biodiversity and the intricate layers of the rainforest. By asking "I wonder..." questions about how plants and animals support healthy ecosystems, teams identify the specific real-world challenges they wish to investigate through their builds.

Phase 2: Refine

In this phase, learners refine the identified problem to ensure it is manageable and feasible for their context. As teams move through the BIOGLOW sessions, they narrow their focus to select specific STEM Careers related to Biodiversity (such as a Wildlife Biologist or Botanist) and scientific tools or technology that could feature in their Team Model. This refinement allows them to weave additional details, such as measuring or pattern identification, into their project.

Phase 3: Plan

Learners develop a systematic plan or design to approach their challenge, drawing on tools like sketching and digital documentation. In the BIOGLOW challenge, this is achieved through processes such as habitat mapping and drawing detailed, labeled diagrams of the Team Model in the Engineering Notebook. Teams plan their LEGO coding requirements, deciding which motorised parts and sensors will best tell their biodiversity story.

Phase 4: Implement

Learners implement their plans using "hands-on and minds-on" learning to create prototypes. During this phase of the BIOGLOW challenge, teams use the LEGO Education SPIKE™ Essential set to construct their unique creatures and research stations. They apply computational thinking to code algorithms that motorise their builds, frequently testing and iterating on their designs to ensure they work as intended.

Phase 5: Evaluate

The final phase involves learners presenting their results, key learning, and reflections to an audience. This phase culminates in the Showcase Festival, where teams share their motorised Team Model and "Show Me" poster with reviewers, family, and friends. Learners reflect on their journey, identifying the Core Values they practised and evaluating how their design solutions help scientists protect biodiversity.

By navigating these phases, the BIOGLOW challenge empowers learners to see themselves as scientists and engineers, fostering the confidence and persistence needed to solve complex environmental problems.



Computational Thinking in BIOGLOW

In the Science, Technology, Engineering and Mathematics (STEM) Education specification (2025), computational thinking is defined as the process used when considering and solving problems in such a way that computers can assist us. It draws directly on the principles of computing to approach challenges.

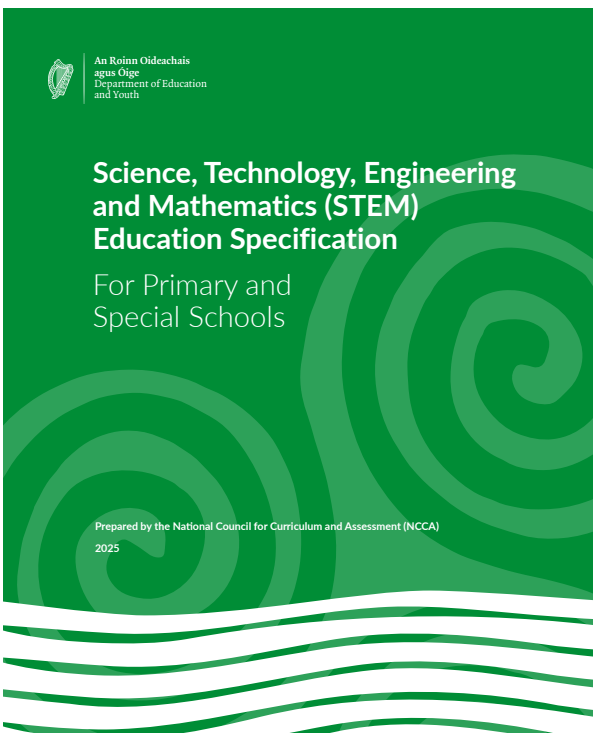


Figure 5 Science, Technology, Engineering and Mathematics (STEM) Education specification (2025)

Computational thinking encourages learners to use logic and reasoning to break down problems into manageable parts and apply prior knowledge to new situations. When learners develop their computational thinking through the BIOGLOW™ challenge, they apply this learning across the Science, Technology, Engineering, and Mathematics (STEM) Education specification and beyond. The concept of computational thinking originates in the work of Seymour Papert, who viewed computers as "learners machines" that allow learners to develop procedural thinking through programming.

By engaging with the BIOGLOW challenge, learners will be supported to achieve learning outcomes from the Technology and Engineering strands; see p.24 of the STEM Specification (2025). These include exploring how to decompose processes into simple algorithms, identifying patterns, and correcting bugs (errors) through both "plugged" and "unplugged" activities. The integrated STEM approach in the BIOGLOW Teacher Guide reflects a core feature of the STEM specification, which seeks dedicated opportunities for learners to connect their learning across STEM subjects and apply it to real-world contexts.

Computational Thinking in Practice

Computational thinking and coding are key elements of BIOGLOW sessions. At the heart of these sessions is a problem-solving process. Teams work logically by changing and testing one variable or code block at a time. This aligns with the engineering design process and the core STEM skills identified in the specification, such as iterating, prototyping, and testing.

By documenting this journey in their Engineering Notebook, learners reflect on the process and debug any part of their build or program. This reflective practice is supported by the specification's emphasis on Evaluating and Communicating and the use of portfolios to demonstrate growth and progression over time.

Core Concepts and Approaches

While engaging in coding, it is vital to assist learners in using correct terminology to describe the capabilities they are developing, as outlined in the Skills across STEM table in the specification. The following table details five core concepts and approaches adapted for the BIOGLOW theme:



Concept or Approach	Explanation	Example in BIOGLOW
Algorithms	Making sets of instructions and steps to create solutions to problems.	Creating a program in the SPIKE™ app to motorise a build, e.g., "Animal Alarm".
Debugging	Finding and fixing errors (bugs) in a program or algorithm in a logical manner.	Iteratively changing code blocks so the lifting platform stops safely at a specific rainforest layer.
Decomposition	Breaking down a complex problem into several smaller, manageable parts.	Organising an ecosystem by its layers (forest floor, canopy) or labelling the structural parts of a modular creature.
Logic	Predicting, analysing, and evaluating for correctness.	Predicting how a colour sensor will react when it detects a specific LEGO animal designed by the team.
Tinkering	Exploring and trying different hands-on approaches to support understanding and problem-solving.	Experimenting with different light patterns and sounds to represent bird calls in the treetops.

Table 3. Five Concepts and Approaches of Computational Thinking developed across BIOGLOW Sessions.

Expanding the Computational Mindset

Beyond the core concepts above, teams will exercise several other approaches essential for modern scientists and engineers, as highlighted throughout the redeveloped curriculum:

- Pattern recognition: Spotting similarities between how rainforest animals and native Irish creatures adapt to their environments.
- Abstraction: Removing unnecessary detail to focus on the most important information, such as when creating a simplified habitat map.
- Evaluation: Making judgements about the effectiveness of their designed plant or scientific tool.
- Persevering and Resilience: Remaining resilient and determined when a code sequence or build does not work on the first attempt.
- Collaborating: Working together as Wildlife Biologists, Botanists, and Coders to construct understanding through collaboration.



The BIOGLOW Teacher Guide supports teachers to use computational thinking in numerous ways, including:

- Providing opportunities for learners to engage with both digital technologies, such as the LEGO Education SPIKE™ Essential set, and non-digital technologies, such as LEGO prototyping pieces, as both users and creators of biodiversity models.
- Broadening learners understanding of computational thinking as a problem-solving approach to tackle real-world challenges like habitat fragmentation and the global biodiversity emergency.
- Assisting learners to decompose [break down] complex ecosystems into manageable parts, such as the specific layers of the rainforest, and to abstract [remove] unnecessary detail when designing their own unique modular creatures.
- Modelling pattern recognition [spotting similarities] and encouraging learners to identify patterns in how both tropical and native Irish species adapt to their environments in both unplugged and plugged activities.
- Facilitating learners to systematically plan, design, create and modify algorithms [sequences of steps] to code an "Animal Alarm" or a motorised research tool, drawing their attention to the precise instructions they are using.
- Challenging learners to test, modify and improve their creations, such as a research station lift, through working collaboratively with peers in roles like Wildlife Biologists, Botanists, and Ecologists.
- Encouraging learners to consider feedback from their teammates, persevere in their explorations when a sensor does not trigger as intended, and to take informed risks as part of the engineering design process.
- Providing opportunities for learners to reflect on the computational thinking process, evaluate their successes and setbacks in building tools to study nature, and generalise their learning to wider environmental conservation contexts.

The Barefoot Computing curriculum (**www.barefootcomputing.org/**) includes a useful graphic which summarises the key concepts and approaches of computational thinking and coding.

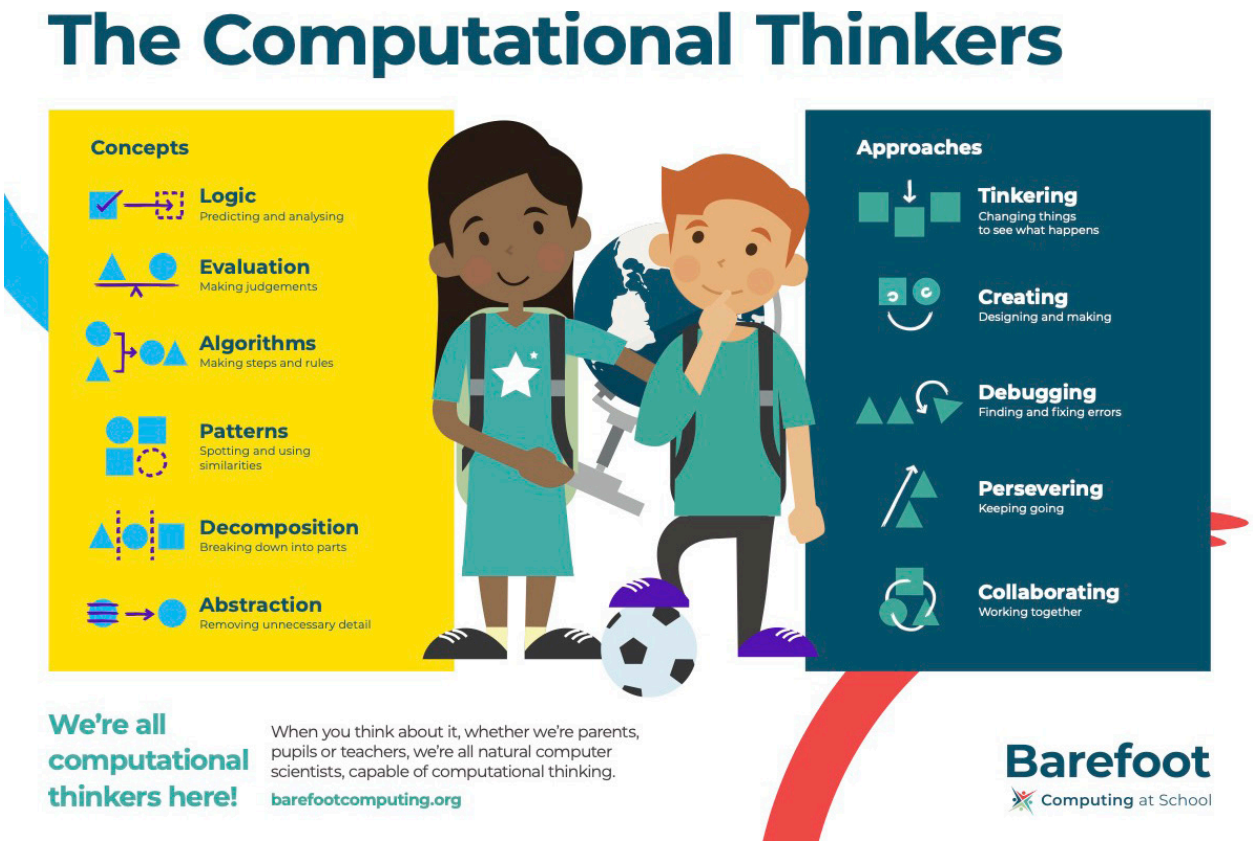


Figure 6. The Computational Thinker: Concepts and Approaches



Design Thinking in BIOGLOW

Design thinking is an action-orientated and practical process designed to support creative problem-solving and innovation. In the context of the BIOGLOW™ challenge, it provides an authentic framework for learners to collaboratively share knowledge, ask questions, and actively engage in solving environmental design problems. By generating questions, planning, and making prototypes, learners develop meaningful research and critical thinking skills as they investigate how to protect global and local biodiversity.

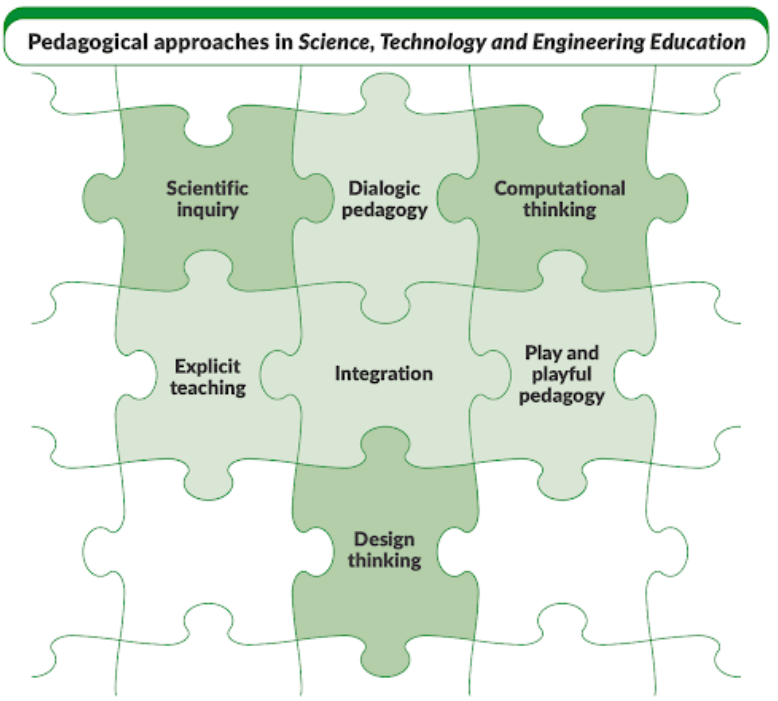


Figure 7. Pedagogical approaches in STEM (2025, p. 33)

The Teacher's Role in Design Thinking

Teachers can effectively facilitate design thinking by:

- Promoting perseverance and a solution-focused attitude when teams encounter challenges during the build process.
- Modelling empathy and perspective-taking, encouraging learners to view environmental problems from the viewpoint of others, such as Wildlife Biologists or the creatures living in the rainforest canopy.
- Assisting learners to select and research design problems that are relevant to their own lives, such as making school grounds more pollinator-friendly or protecting a local Irish hedgerow.
- Providing opportunities for teams to brainstorm and generate solutions in pairs and groups.
- Facilitating the prototype design process, bringing attention to how the learners are working "like an engineer".
- Challenging teams to plan, test, and refine their models through collaboration and deliberation.
- Encouraging creative risk-taking and providing space for students to reflect on their successes and setbacks.

Engineering Learning Outcomes

The STEM Education specification (p. 25) outlines clear progression in how learners should engage with the design thinking process through the Engineering strand. Throughout the BIOGLOW sessions, learners work towards these outcomes by:

- Exploring real and imagined design problems relevant to their lives and sharing ideas on how these might be solved.
- Using empathy to identify problems and considering "user-needs", which in this season includes the requirements of plants, animals and other living things to remain healthy within an ecosystem.
- Systematically planning, making, testing, and evaluating a prototype, such as a motorised research station lift or a tool to monitor biodiversity.
- Making iterations and improvements based on reflections and feedback from their peers.
- Working collaboratively to define and refine problems, using sketching and digital tools to present an analysis of their iterative design process.

This approach ensures that the Engineering Design Process, *'Explore, Create, Test, and Share'*, is not just a series of steps but a mindset that fosters adaptability, responsiveness, and a sense of empowerment as learners realise they have the capacity to make a positive impact on the natural world.



The Seven Key Competencies of the Redeveloped Primary Curriculum

The Primary Curriculum Framework (2023) defines seven key competencies that are inextricably linked and relevant for all learners from Junior Infants to Sixth Class. These competencies empower learners to adapt to complex real-world situations, such as understanding and protecting biodiversity—the vast variety of all living things and the intricate ways they work together within ecosystems. Through the BIOGLOW™ challenge, learners develop these capabilities in an integrated way as they investigate biodiversity, including global and local habitats.

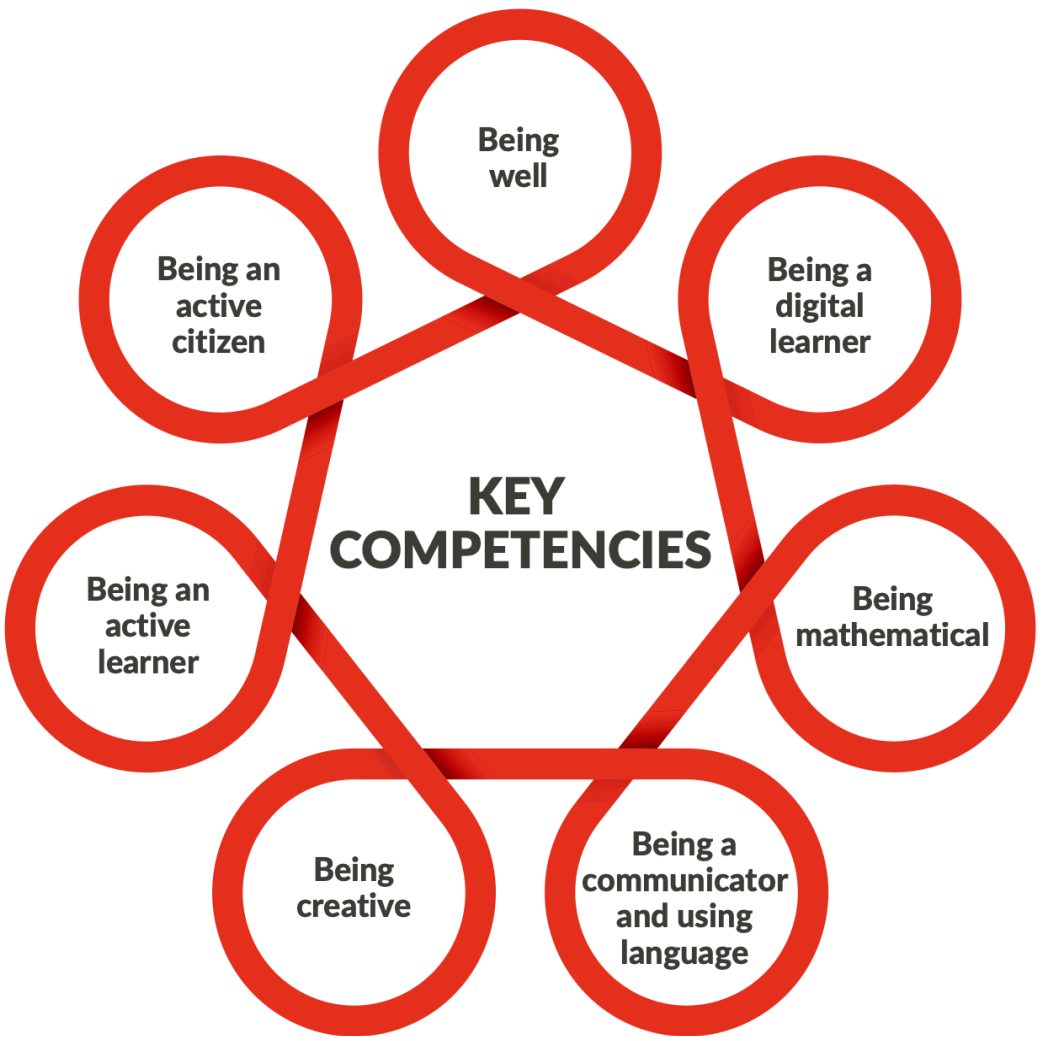
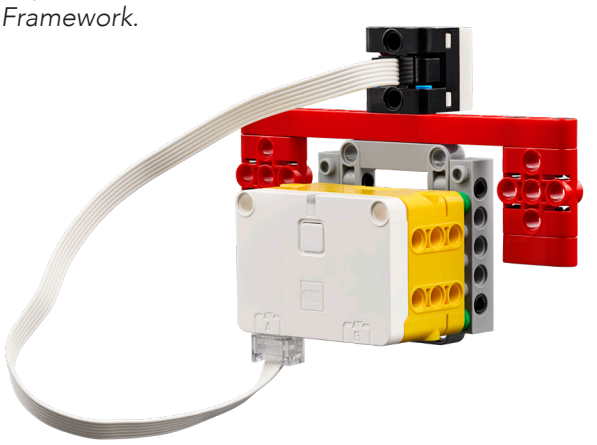


Figure 8. The Seven Key Competencies of the Primary Curriculum Framework.

This *FIRST* LEGO League Explore BIOGLOW Teacher Guide has been designed to support the development of all seven of the key competencies of the Primary Curriculum Framework in an integrated way as presented in Figure 8 and outlined on the following pages:



Being an Active Citizen

The 'Being an Active Citizen' competency fosters within learners the knowledge, skills, concepts, attitudes, values and dispositions that motivate and empower them as citizens to take positive actions to live justly and sustainably. It enables learners to question, critique and understand what is happening in the world and how aspects of our lives can be improved to ensure we are helping all living things to survive and thrive. It places democratic practices at the centre of the learning process.

This competency motivates learners to take positive actions to live sustainably and act as custodians of the planet. In the context of the BIOGLOW challenge, learners engage with the reality of Ireland's biodiversity emergency and the global loss of species. They learn to recognise the intrinsic value of nature and their responsibility to help protect and enhance local species-richness.

Learners are working collaboratively to identify and solve problems, and make decisions through democratic practices. The 'Being an Active Citizen' competency is embedded within *FIRST* LEGO League Explore BIOGLOW in that the challenge and associated sessions foster within learners the knowledge, skills, concepts, attitudes, values and dispositions that motivate and empower them as citizens.

Being Creative

The 'Being Creative' competency focuses on recognising and nurturing learners' innate creativity, providing learners with opportunities for meaningful creative experiences through exploring and expressing ideas and reflecting on experiences.

Learners develop this competency by connecting with the natural environment through outdoor learning and "hands-on" experiences. By exploring the "living classrooms" of their school grounds or local hedgerows, students build a deeper appreciation for how living things survive and flourish. They develop metacognitive skills by reflecting on their own learning journey throughout the twelve sessions.

FIRST LEGO League Explore BIOGLOW actively fosters learner creativity, encouraging them to be curious, open-minded, and imaginative. This encompasses attributes such as participating in and enjoying creative experiences relating to the theme, demonstrating curiosity, imagination, and innovation, as well as exploring alternative ways of communicating.



Being a Digital Learner

The 'Being a Digital Learner' competency in the Primary Curriculum Framework aims to support learners in becoming creative, confident, and critical users of digital technology. Throughout *FIRST* LEGO League Explore BIOGLOW, learners will develop their knowledge, skills, concepts, attitudes, values, and dispositions through problem-solving, experimenting, and creating, using a wide range of digital technologies.

Learners use technology, such as the LEGO Education SPIKE™ Essential set, to model scientific processes and environmental monitoring. They explore how modern scientists use digital tools like trackers, GPS devices, and sensors to safely watch animals and track forest growth without hurting nature

Learners further use simple software/ apps/websites for collaborative research. *FIRST* LEGO League Explore BIOGLOW develops learners' responsible, safe and ethical use of technology by embedding digital technologies in the learning process.

Being a Communicator and using Language

According to the new Primary Curriculum Framework, the 'Being a Communicator and using Language' competency develops learners' understanding and enjoyment of interacting with others. Communicating and using language means being able to understand, interpret, and use different forms of communication, including gesture, expression, spoken language, printed text, broadcast media, and digital media.

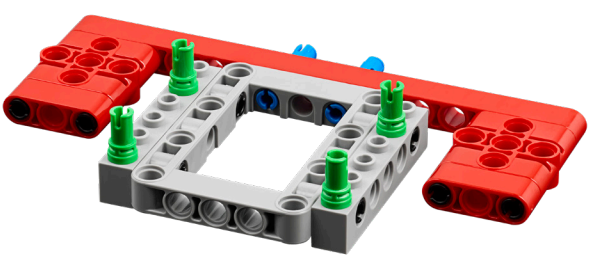
Learners use this competency to document their discoveries and engage in storytelling about healthy ecosystems. They develop a rich vocabulary related to rainforest layers and Irish habitats. The final "Show Me" poster and showcase festival provide an authentic audience for teams to share their learning.



Being Mathematical

The 'Being Mathematical' competency aims to aid learners in developing and applying mathematical thinking to solve a range of problems in everyday situations. In order to participate effectively in today's world, learners need to be able to think and communicate quantitatively, to make sense of data, to have spatial awareness, and to recognise and understand patterns and sequences. Being mathematical involves learners drawing upon a range of knowledge, skills, concepts, attitudes, values, and dispositions as they recognise and interpret real-world information presented mathematically.

This competency is applied through habitat mapping, where students show the geographic distribution of different habitats and species. Teams also record and interpret data from biodiversity awareness surveys and species sightings, using graphs and charts to evaluate how ecosystems change over time.



Being Well

The 'Being Well' competency fosters self-awareness and promotes the importance of learners seeing themselves as capable and resourceful. It helps learners become positive and engaged in their learning and realise their own uniqueness and potential. It supports healthy relationships with themselves, their peers, their family, and the wider world.

Engaging with biodiversity supports child wellbeing by encouraging a meaningful connection with nature and the outdoors. Recognising that healthy environments lead to healthy humans, appreciating the beauty of the natural world and working as a team to address environmental problems helps students develop a sense of purpose, resilience, and community belonging.

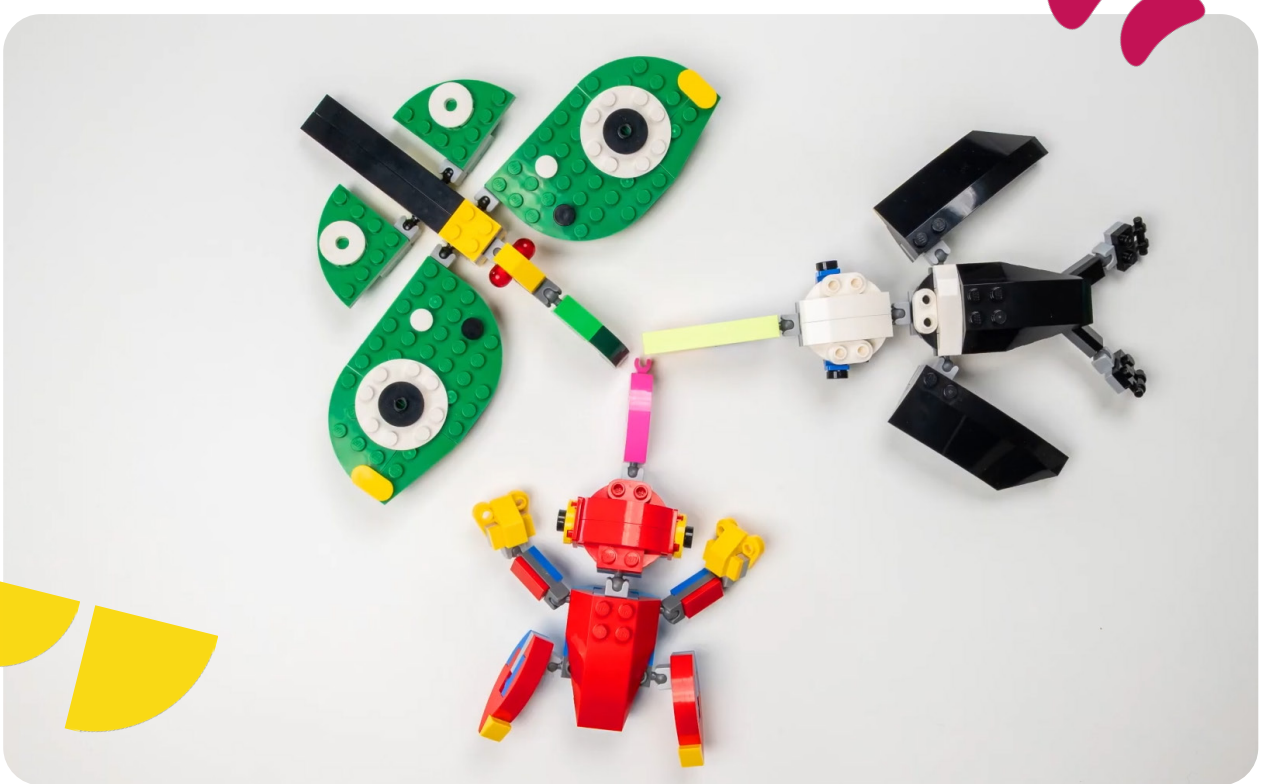
The Core Values of *FIRST* LEGO League Explore BIOGLOW facilitate learners in being self-aware and resilient, acting responsibly and showing care towards themselves and others. They are encouraged to be persistent and flexible in navigating challenges during their investigations. The investigative approach of any challenge encountered is conducive to fostering cooperation, positive team relationships, and self-improvement.

Being an Active Learner

Finally, the 'Being an Active Learner' competency is aimed at aiding learners to develop themselves as learners, individually and in collaboration with others.

It promotes the development of the knowledge, skills, concepts, attitudes, values, and dispositions needed for being an active and continuous learner.

The structure of *FIRST* LEGO League Explore BIOGLOW facilitates learners in being active during sessions, facilitating them in learning how to communicate, set personal and collaborative learning goals and navigate complex situations inherent in discovery through practical, hands-on engagement.They interpret their findings by physically designing, building, and coding models. Through developing this competency, learners also learn to reflect on their learning process, an important feature of *FIRST* LEGO League Explore BIOGLOW.



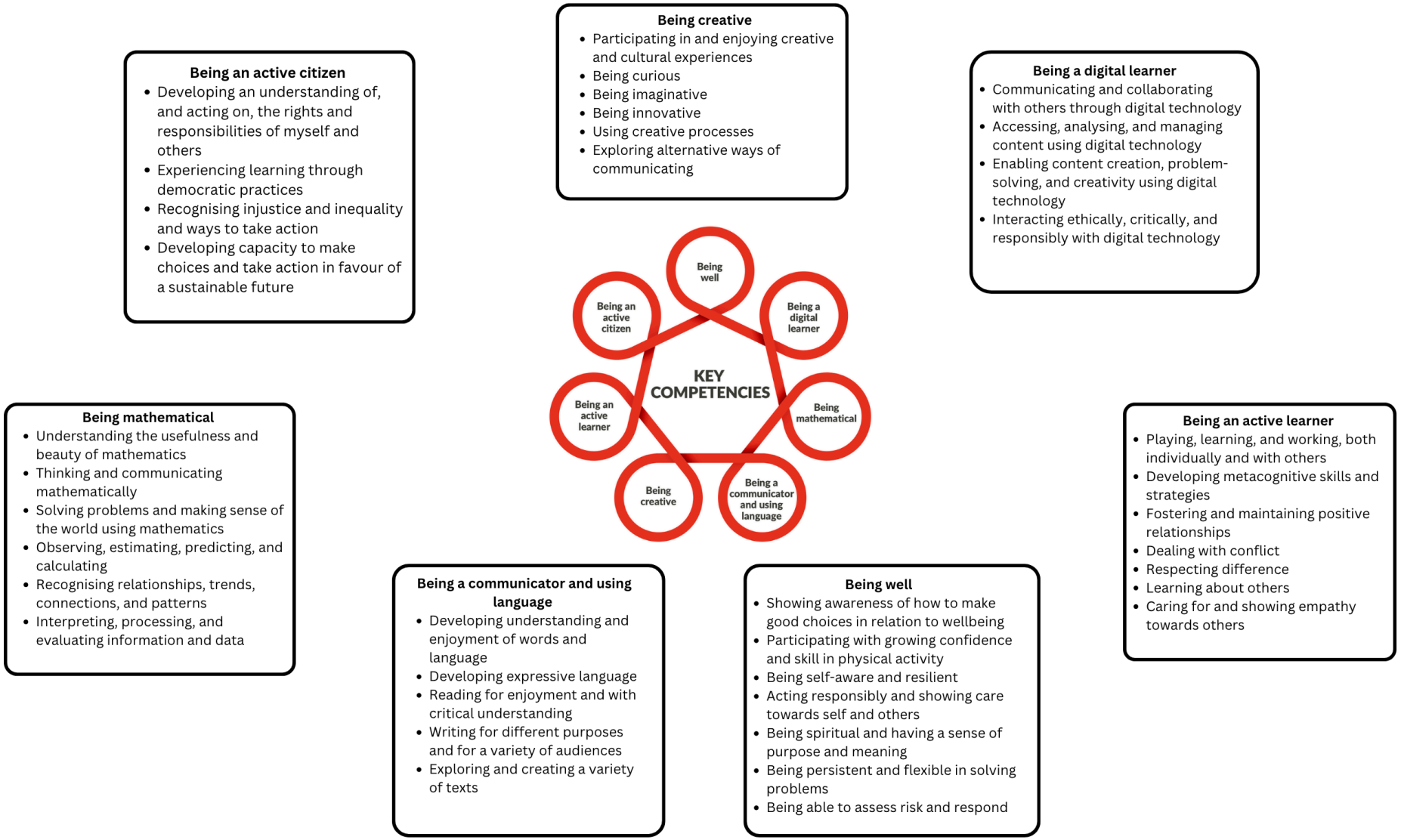
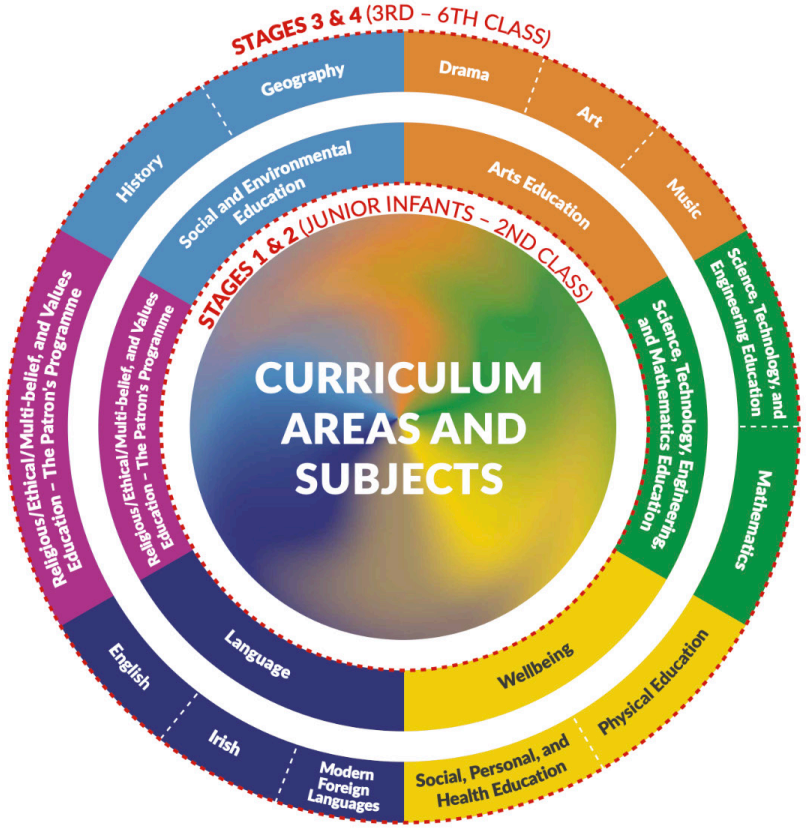


Figure 9. The Seven Key Competencies of the new Primary Curriculum Framework.

Curriculum areas and subjects of the Primary Curriculum

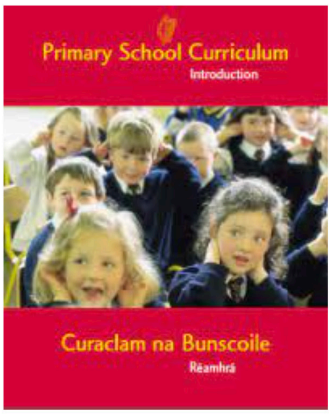
The curriculum is presented in five broad curriculum areas:

1. Language
2. Science, Technology, Engineering, and Mathematics (STEM) Education
3. Wellbeing
4. Arts Education
5. Social and Environmental Education.

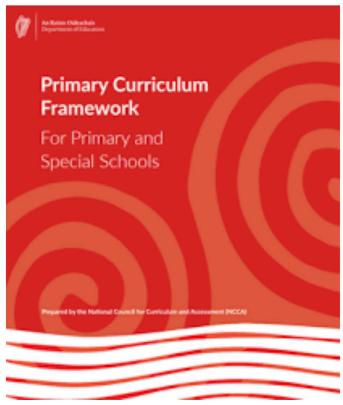


	Language	Science, Technology, Engineering and Mathematics Education	Wellbeing	Arts Education	Social and Environmental Education	Religious / Ethical / Multi-belief, and Values Education - The Patron's Programme
Stages 1 and 2 Junior Infants - 2nd Class	Language (Irish and English)	Science, Technology, Engineering and Mathematics Education	Wellbeing	Arts Education	Social and Environmental Education	Religious / Ethical / Multi-belief, and Values Education - The Patron's Programme
Stages 3 and 4 3rd - 6th Class	Irish English Modern Foreign Languages	Science, Technology and Engineering Mathematics	Social Personal and Health Education Physical Education	Drama Art Music	History Geography	Religious / Ethical / Multi-belief, and Values Education - The Patron's Programme

Connections to policy



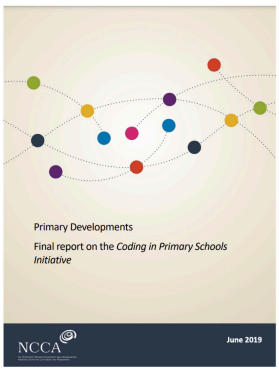




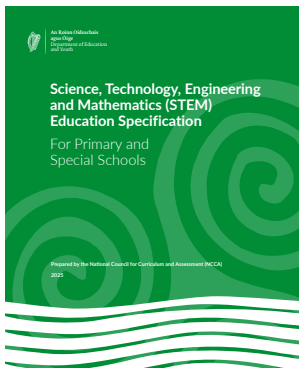
FIRST LEGO League Explore has explicit and embedded connections across the Irish Primary School Curriculum.



FIRST LEGO League Explore is directly linked with a number of domains, standards and statements across both dimensions of the Digital Learning Framework (DLF). This is a school self-evaluation process and aligns with the Digital Strategy for Schools to 2027.







FIRST LEGO League Explore has strong connections with a range of recent policy initiatives including Department of Education and Youth Circular 0052/2026, which outlines the rollout and support structures for the redeveloped Primary School Curriculum starting in September 2026. This BIOGLOW Teacher Guide aims to support teachers and school leaders by illustrating the alignment between the programme and enactment of the STEM curriculum.

Table 3. Policy connections

How does *FIRST* LEGO League Explore BIOGLOW connect to the Irish Primary Curriculum?

Table 4 below presents the connections to the 1999 and 2025 Irish Primary School Curricula.

1999 Curriculum	2025 Curriculum
Science **Strand(s):** Living things; Environmental awareness and care; Energy and forces; Materials. **Skill(s):** **Working scientifically:** Questioning, observing, predicting, investigating and experimenting, estimating and measuring, analysing (including sorting and classifying), recording and communicating. **Designing and making:** Exploring, planning, making, and evaluating. **Mathematics** **Strand(s):** Data; Shape and space; Measures; Number; Early mathematical activities. **Skill(s):** Applying and problem-solving, communicating and expressing, integrating and connecting, reasoning, and implementing.	**STEM Education (Science, Technology, Engineering, and Mathematics)** **Strand(s):** Living things; Nature of STEM; Technology; Engineering; Data and chance; Shape and space; Measures. **Skill(s):** **Scientific & Engineering:** Questioning, investigating the natural world, observing, identifying patterns, perspective-taking (acting as specialists), prototyping, making, testing, iterating, and evaluating design effectiveness. **Technology:** Data handling, using digital tools to record/research, algorithmic thinking (sequencing and debugging), and exploring how inputs, processes, and outputs work together. **Mathematics:** Mathematising, representing and interpreting data, and estimating/measuring. Specifically within the Data strand, learners focus on sorting and classifying objects into sets based on features as part of the reasoning and problem-solving progression continuum. **Key Competencies:** AC, AL, CL, C, DL, M, W.

Table 4a. Irish Primary Curriculum Connections

1999 Curriculum	2025 Curriculum
Gveography **Strand(s):** Natural environments; Human environments; Environmental awareness and care. **Skill(s):** **Working as a geographer:** Geographical investigation skills (Questioning, observing, predicting, investigating, analysing, recording, and communicating). **Maps, globes and graphical skills:** Developing graphicacy through habitat mapping and using pictures/models. **History** **Strand(s):** Local studies; Continuity and change over time; Story; Early people and ancient societies. **Skill(s):** **Working as an historian:** Time and chronology, using evidence, change and continuity, cause and effect, synthesis and communication, and empathy (perspective-taking).	**Social and Environmental Education (SEE)** **Strand(s):** My locality; The island of Ireland; Europe and the wider world. **Strand Unit(s):** Environment and sustainable living; Identity and heritage; People and places. **Skill(s):** Geographical and historical questioning, investigating local natural environments, mapping and graphicacy, interpreting and analysing evidence, and communicating findings about biodiversity protection and Ireland's natural heritage. **Key Competencies:** AC, AL, CL, C.
Visual Arts **Strand(s):** Drawing; Construction. **Skill(s):** Making drawings, making constructions, and looking and responding. **Concepts:** Developing an awareness of line, shape, form, and space.	**Arts Education** **Strand(s):** Exploring and creating; Performing and presenting; Responding and connecting. **Strand Unit(s):** 2D Art (Drawing); 3D Art (Construction); Art, Drama, Music and other artforms. **Skill(s):** Generating ideas, representing environmental and scientific themes through artistic media (posters/ models), constructing, designing, improvising, and evaluating personal and collaborative arts-making. **Key Competencies:** AL, CL, C, DL, W.

Table 4b. Irish Primary Curriculum Connections

1999 Curriculum	2025 Curriculum
English (Language/Literacy) **Strand(s):** Oral Language; Writing; Reading. **Skill(s):** Receptive and Expressive Language Skills (Listening, speaking, and discussing); Communicating, understanding, and exploring and using language.	**Language (English)** **Strand(s):** Oral Language; Writing; Reading. **Strand Unit(s):** Communicating; Understanding; Exploring and using. **Skill(s):** Engagement, listening, expressing complex ideas, acquiring and using sophisticated subject-specific vocabulary (e.g., biodiversity, adaptation, algorithm), creating multimodal texts (posters), and supplying/justifying information to audiences. **Key Competencies:** CL, AL, C.
SPHE **Strand(s):** Myself and others; Myself and the wider world. **Skill(s):** Communication, co-operation, and decision-making. **Core Values:** Practising **Teamwork, Inclusion, Discovery, Impact,** and **Fun** throughout collaborative tasks.	**Wellbeing** **Strand(s):** Community and belonging; Emotional and relational education. **Strand Unit(s):** Sense of belonging; Citizenship; Relationships; Resilience. **Skill(s):** Collaborating through teamwork, identifying features of successful cooperation, reflecting on the personal relevance of the learning journey, and proposing actions to address local environmental concerns. **Key Competencies:** W, AC, AL, CL.

Table 4c. Irish Primary Curriculum Connections

<table>
<tr><td>Session</td><td colspan="2">Session 1: Biodiversity and Ireland</td></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will be introduced to the concept of biodiversity, which can also be referred to as ‘nature’, and will learn about the world around them in the context of habitats, ecosystems and the living things that exist in Ireland.
Learners will be enabled to
• Begin to understand and appreciate what biodiversity is and explain it in their own words
• Identify that a habitat is a place where a living thing (this could be a plant, animal, insect or anything else) makes its home
• Identify that an ecosystem is a community of living things in a particular area, which also includes the non-living things that they interact with</td></tr>
<tr><td>Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td></td><td>Science
Strand(s): Living things; Environmental awareness & care
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment
Skill(s): Working scientifically
Scientific Investigation Skills (Questioning, Observing, Predicting, Investigating and experimenting, Analysing (Sorting and classifying suggested Irish species), Recording and communicating)
Concepts: Biodiversity (Variety of life); Adaptation; Interdependence within ecosystems; Stewardship

Geography
Strand(s): Natural environments; Environmental awareness and care
Strand Unit(s): The local natural environment; Environmental awareness; Caring for my locality
Skill(s): Working as a geographer
Geographical Investigation Skills (Questioning, Observing, Investigating and experimenting with local habitats, Analysing, Recording and communicating benefits provided by nature)
Concepts: A sense of place; A sense of space; Interrelationship of flora, fauna, and human activity

History
Strand(s): Continuity and change over time; Local studies
Strand Unit(s): My locality through the ages; Continuity and change in the local environment
Skill(s): Working as an historian
Historical Investigation Skills (Questioning, Observing, Using evidence to understand the historical context of Ireland’s biodiversity post-Ice Age, Time and chronology)
Concepts: Change and continuity; Cause and effect (impact of island formation on species variety)

Visual Arts
Strand(s): Drawing
Strand Unit(s): Making drawings
Skill(s): Making drawings ; Looking and responding
Concepts: Awareness of line, shape, form, and space

Language (English)
Strand(s): Oral Language; Writing
Strand Unit(s): Communicating; Understanding; Exploring and using language
Skill(s): Receptive and Expressive Language Skills (Listening, speaking, and discussing; Acquiring specialised vocabulary such as biodiversity, ecosystem, habitat, entomologist; Expressing ideas about environmental benefits)

SPHE
Strand(s): Myself and the wider world
Strand Unit(s): Developing citizenship; Environmental care
Skill(s): Communication; Co-operation (Practicing the Core Values of Teamwork and Discovery during group activities)
Concepts: Stewardship; Social responsibility; Being custodians of the Earth for future generations

Mathematics
Strand(s): Data
Strand Unit(s): Representing and interpreting data
Skill(s): Applying and problem-solving; Communicating and expressing; Reasoning (Grouping and charting suggestions of Irish living things)</td><td>STEM Education

Strand(s): Living things
Strand Unit(s): Biodiversity / Animal life / Plant life / Nature and the outdoors
Skill(s): Scientific questioning, investigating the natural world, observing, and identifying patterns in local ecosystems.
Key Competencies: AC, AL, CL

STEM Strand(s): Nature of STEM
Strand Unit(s): STEM in our world
Skill(s): Perspective-taking (acting as a wildlife biologist, ecologist, or entomologist) and exploring how STEM professionals solve environmental problems.
Key Competencies: AL, DL, M

Strand(s): Technology
Strand Unit(s): Understanding technology / Using technology
Skill(s): Exploring how technologies assist scientists in monitoring biodiversity and using digital tools (videos/research) to enhance learning.
Key Competencies: AL, DL, W

Strand(s): Data
Strand Unit(s): Data
Skill(s): Representing and interpreting information (e.g., grouping and charting suggested living things in Ireland).
Key Competencies: M, AL, CL

Social and Environmental Education (SEE)

Strand(s): My locality / The island of Ireland
Strand Unit(s): Environment and sustainable living / Identity and heritage
Skill(s): Questioning, investigating local natural environments, and communicating findings about biodiversity protection and Ireland’s natural heritage.
Key Competencies: AC, AL, CL

Arts Education
Strand(s): Exploring and creating
Strand Unit(s): 2D Art (Drawing)
Skill(s): Generating ideas and representing environmental themes (habitats and wildlife) through artistic media.
Key Competencies: AL, CL, C

Language
Strand(s): Oral Language
Strand Unit(s): Communicating; Understanding; Exploring and using
Skill(s): Engagement, listening, and expressing ideas using an expanding subject-specific vocabulary (e.g., biodiversity, ecosystem, habitat).
Key Competencies: CL, AL

Wellbeing
Strand: Community and belonging Strand Unit(s): Sense of belonging / Citizenship
Skill(s): Collaborating through teamwork and identifying how a healthy environment contributes to collective wellbeing.
Key Competencies: W, AL, AC</td></tr>
</table>

Table 5a. BIOGLOW Curriculum Connections

Session	Session 2: Biodiversity Around Us	
Purpose and Learning Outcomes	Learners will prepare to investigate biodiversity in their school or an area around their school, specifically focusing on habitats for pollinators. *Learners will be enabled to* • Consider the types of trees that are commonly found around us and classify them as native or non-native • Begin to understand and appreciate the work of wildlife biologists • Work as scientists to prepare for fieldwork exploring and describing biodiversity, ensuring they collect useful data. • Utilise their mathematical skills in measure, data and spatial awareness to help them to map and prepare to explore biodiversity in a specific area.	
Curriculum Connections	**1999**	**2025**
	Science **Strand(s):** Living things; Environmental awareness & care **Strand Unit(s):** Plants and animals; Environmental awareness; Caring for the environment **Skill(s):** Working scientifically Scientific Investigation Skills (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing (Sorting and classifying), Recording and communicating) **Geography** **Strand(s):** Natural environments; Environmental awareness and care **Strand Unit(s):** The local natural environment; Environmental awareness; Caring for my locality **Skill(s):** Working as a geographer **Geographical Investigation Skills** (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating survey data) **Mathematics** **Strand(s):** Measures; Data; Shape and space **Strand Unit(s):** Area; Representing and interpreting data; Spatial awareness **Skill(s):** Applying and problem-solving; Communicating and expressing; Integrating and connecting; Reasoning; Implementing **History** **Strand(s):** Continuity and change over time **Strand Unit(s):** Environmental change (Focusing on the historical arrival of native trees via land bridges post-Ice Age) **Skill(s):** Working as an historian **Historical Investigation Skills** (Questioning, Observing, Using evidence to understand historical biodiversity, Cause and effect) **Visual Arts** **Strand(s):** Drawing **Strand Unit(s):** Making drawings **Skill(s):** Making drawings (Sketching fieldwork maps and leaf details); Looking and responding **Visual Arts Concepts** (An awareness of line, An awareness of shape, An awareness of form, An awareness of space) **Language (English)** **Strand(s):** Oral Language; Writing **Strand Unit(s):** Communicating; Understanding; Exploring and using language **Skill(s):** Receptive and Expressive Language Skills (Listening, speaking, and discussing; Acquiring specialised vocabulary such as pollinator, native, non-native, quadrat, biodiversity) **SPHE** **Strand(s):** Myself and the wider world **Strand Unit(s):** Developing citizenship; Environmental care **Skill(s):** Communication; Co-operation; Decision-making (Practicing the Core Values of **Teamwork** and **Discovery** during prep work)	**STEM Education** **Strand(s):** Living things **Strand Unit(s):** Biodiversity / Plant life / Animal life **Skill(s):** Scientific questioning, investigating, observing, and classifying (e.g., identifying tree species and pollinator-friendly plants).. **Key Competencies:** AC, AL, CL **STEM Strand(s):** Nature of STEM **Strand Unit(s):** STEM in our world / How STEM works **Skill(s):** Exploring and experiencing how people working in STEM (wildlife biologists) carry out investigations to solve problems; perspective-taking. **Key Competencies:** AL, DL, M **Strand(s):** Technology **Strand Unit(s):** Understanding technology **Skill(s):** Exploring how technologies help us live and work in the world (e.g., using digital resources to identify species and planning how technology assists scientific fieldwork). **Key Competencies:** AL, DL, W **Strand(s):** Data / Measures / Shape and space **Strand Unit(s):** Data / Measuring / Spatial awareness & location **Skill(s):** Estimating and measuring, representing, and interpreting (e.g., sketching maps of the locality, calculating the approximate area of habitats, and preparing tally sheets). **Key Competencies:** M, AL, CL **Strand(s):** Engineering **Strand Unit(s):** Knowledge of design process **Skill(s):** Sketching and planning (e.g., designing the fieldwork survey layout and mapping specific quadrants for observation). **Key Competencies:** AL, C, CL **Social and Environmental Education (SEE)** **Strand(s):** My locality **Strand Unit(s):** Environment and sustainable living / People and places **Skill(s):** Questioning, investigating, and sense of place and space (e.g., investigating the geographical distribution of habitats in the school environment). **Key Competencies:** AC, AL, C **Arts Education** **Strand(s):** Exploring and creating **Strand Unit(s):** Art (Drawing) **Skill(s):** Generating ideas and representing environmental themes (habitats and tree leaves) through artistic media & mapping. **Key Competencies:** AL, CL, C **Language** **Strand(s):** Oral Language **Strand Unit(s):** Communicating; Understanding; Exploring and using **Skill(s):** Engagement, listening, and acquiring technical vocabulary (e.g., pollinator, native, non-native, quadrat, biodiversity). Key Competencies: CL, AL **Wellbeing** **Strand(s):** Community and belonging **Strand Unit(s):** Citizenship / Sense of belonging **Skill(s):** Identifying ways to take responsibility for the environment and practicing the core values of **Teamwork** and **Discovery**. **Key Competencies:** W, AC, AL

Table 5b. BIOGLOW Curriculum Connections

<table>
<tr><td>Session</td><td colspan="2">Session 3: Biodiversity Around Us - A Focus on Pollinators</td></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will investigate biodiversity in their school or an area around their schools, specifically focusing on habitats for pollinators.
Learners will be enabled to
• Explore, map and describe biodiversity in their school grounds or in an area around their school.
• Identify habitats for pollinators in or around their school.
• Propose ideas to further support pollinators by improving their habitats in areas in or around their school.</td></tr>
<tr><td>Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td></td><td>Science
Strand(s): Living things; Environmental awareness & care.
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment.
Skill(s): Working scientifically.
Scientific Investigation Skills (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing (Sorting and classifying, Recognising patterns), Recording and communicating).

Mathematics
Strand(s): Measures; Data; Shape and space.
Strand Unit(s): Area; Representing and interpreting data; Spatial awareness (Planning fieldwork quadrants and tallying species).
Skill(s): Applying and problem-solving; Communicating and expressing; Reasoning (Interpreting quadrat counts and abundance vs. scarcity).

Geography
Strand(s): Natural environments; Environmental awareness and care.
Strand Unit(s): The local natural environment; Environmental awareness; Caring for the environment.
Skill(s): Working as a geographer; Maps, globes and graphical skills (Developing graphicacy through habitat mapping).
Geographical Investigation Skills (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating survey data).

History
Strand(s): Continuity and change over time; Local studies.
Strand Unit(s): Continuity and change in the local environment.
Skill(s): Working as an historian.
Historical Investigation Skills (Questioning, Observing, Using evidence (to understand how land use has changed), Synthesis and communication, Empathy (perspective-taking as a pollinator or local inhabitant)).

English (Language)
Strand(s): Oral Language; Writing.
Strand Unit(s): Communicating; Understanding; Exploring and using language.
Skill(s): Receptive and Expressive Language Skills (Listening, speaking, and discussing observations; Acquiring vocabulary such as pollinator, quadrat, abundance, biodiversity).

SPHE
Strand(s): Myself and the wider world.
Strand Unit(s): Developing citizenship; Environmental care.
Skill(s): Communication; Co-operation; Decision-making (Practicing the Core Values of Teamwork and Discovery during outdoor fieldwork).
Concepts: Stewardship; Social responsibility; Individual & community responsibility for the local natural environment.

Visual Arts
Strand(s): Drawing.
Strand Unit(s): Making drawings (Sketching site maps and recording “Treasures vs. Troubles”).
Skill(s): Making drawings; Looking and responding. Visual Arts Concepts: An awareness of line; An awareness of shape; An awareness of form; An awareness of space</td><td>STEM Education

Strand(s): Living things.
Strand Unit(s): Biodiversity / Plant life / Animal life / Nature and the outdoors.
Skill(s): Scientific questioning, investigating, observing, classifying, and identifying patterns.
Key Competencies: AC, AL, CL.

Strand(s): Data / Measures.
Strand Unit(s): Data / Measuring.
Skill(s): Representing, estimating, and measuring (e.g., counting species and charting abundance).
Key Competencies: M, AL, CL.

Strand(s): Technology.
Strand Unit(s): Understanding technology / Using technology.
Skill(s): Data handling, using digital and non-digital technologies (such as quadrats and tally sheets) to enhance learning.
Key Competencies: AL, C, DL.

Strand(s): Engineering.
Strand Unit(s): Knowledge of design process.
Skill(s): Sketching (mapping) and perspective-taking (using empathy to identify habitat needs for pollinators).
Key Competencies: AL, C, CL.

Strand(s): Nature of STEM.
Strand Unit(s): STEM in our world.
Skill(s): Exploring how ecologists and citizen scientists carry out investigations to solve environmental problems.
Key Competencies: AL, DL, M.

Social and Environmental Education (SEE)

Strand(s): My locality.
Strand Unit(s): Environment and sustainable living.
Skill(s): Mapping/Graphicacy, investigating, and identifying opportunities to become involved in protecting local biodiversity.
Key Competencies: AC, AL, CL.

Arts EducationStrand(s): Exploring and creating.
Strand Unit(s): 2D Art (Drawing).
Skill(s): Generating ideas and representing environmental themes through sketching site maps.
Key Competencies: AL, CL, C.

LanguageStrand(s): Oral Language / Writing.
Strand Unit(s): Communicating; Understanding; Exploring and using.
Skill(s): Engagement, listening, and acquiring subject-specific vocabulary (e.g., pollinator, quadrat, abundance).
Key Competencies: CL, AL.

Wellbeing Strand(s): Community and belonging.
Strand Unit(s): Citizenship / Sense of belonging.
Skill(s): Teamwork, co-operation, and proposing actions to address local environmental stewardship.
Key Competencies: W, AC, AL</td></tr>
</table>

Table 5c. BIOGLOW Curriculum Connections

Session	Session 4: Rainforests	
Purpose and Learning Outcomes	Learners will be introduced to the Tropical Rainforest ecosystem and build a LEGO model to help think about how life differs at the different layers of the rainforest. *Learners will be enabled to* • Identify and discuss different types of life present in a rainforest ecosystem • Begin to understand and appreciate the importance of rainforests • Begin to appreciate how and why life differs across different rainforest layers	
Curriculum Connections	**1999**	**2025**
	Geography **Strand(s):** Human environments; Natural environments; Environmental awareness and care **Strand Unit(s):** People and places in other areas; The local natural environment; Environmental awareness; Caring for the environment **Concept(s):** A sense of place; a sense of space **Skill(s):** Questioning; observing; recording and communicating; investigating global environmental issues **Science** **Strand(s):** Living things; Environmental awareness and care **Strand Unit(s):** Plant and animal life; Environmental awareness; Caring for the environment **Concept(s):** Interdependence; adaptation; ecosystems **Skill(s):** Working scientifically (observing, questioning, identifying patterns); Designing and making (exploring, planning, making, evaluating the LEGO tree model) **Visual Arts** **Strand(s):** Construction; Drawing **Strand Unit(s):** Making constructions; Making drawings **Concept(s):** Awareness of line, form, and space **Skill(s):** Making 3D constructions (LEGO tree); making drawings (extension diagram activity); looking and responding **English (Language)** **Strand(s):** Oral Language; Writing **Strand Unit(s) / Element(s):** Communicating; Understanding; Exploring and using language **Skill(s):** Listening; speaking; discussing; persuasive speaking/writing (Eco-Guardians debate); acquiring specialised vocabulary (e.g., Canopy, Emergent, Understory) **SPHE** **Strand(s):** Myself and others; Myself and the wider world **Strand Unit(s):** My friends and other people; Relating to others; Developing citizenship; Environmental care **Concept(s):** Social responsibility; stewardship **Skill(s):** Communication; co-operation; decision-making; practising Teamwork and Inclusion Core Values	**STEM Education** **Strand(s)**: Nature of STEM **Strand Unit(s)**: STEM in our world. **Element(s)**: Exploring and understanding. **Key Competencies**: AL, DL, M **Strand(s)**: Living things **Strand Unit(s)**: Biodiversity / Animal life **Element(s)**: Explore and investigate the interdependence of living things within ecosystems and how they adapt to survive. **Skill(s)**: Scientific questioning, observing, identifying patterns, inferring. **Key Competencies**: AL, CL, M **Strand(s)**: Engineering **Strand Unit(s)**: User-focused design **Element(s)**: Use empathy to consider user-needs. Systematically plan, make, test, and evaluate a design prototype. **Skill(s)**: Prototyping, making (constructing), perspective-taking. **Key Competencies**: AL, C, CL **Arts Education** **Strand(s)**: Exploring and creating **Strand Unit(s)**: 3D Art (Construction) **Element(s)**: Explore, express and represent ideas and themes in a range of 2D and 3D art. **Skill(s)**: Constructing, designing, expressing, choice of materials. **Key Competencies**: AL, CL, C **Language** **Strand(s)**: Oral Language **Strand Unit(s)** / **Element(s)**: Communicating; Understanding; Exploring and using **Element(s)**: Acquire subject-specific vocabulary to support comprehension; interact using increasingly sophisticated language. **Skill(s)**: Listening, speaking, discussing, persuading (Extension debate). **Key Competencies**: CL, AL **Wellbeing** **Strand(s)**: Emotional and relational education **Strand Unit(s)**: Relationships **Element(s)**: Identify and apply key features of teamwork and co-operation. **Skill(s)**: Collaborating, cooperating, reflecting, decision-making. **Key Competencies**: W, AL, CL **Social and Environmental Education (SEE)** **Strand(s):** Europe and the wider world **Strand Unit(s):** Environment and sustainable living **Element(s):** Investigate, name and describe physical features of natural environments (biodiversity) and identify opportunities to protect them. **Skill(s):** Questioning, investigating, interpreting and analysing, communicating. **Key Competencies:** AC, AL, CL

Table 5d. BIOGLOW Curriculum Connections

<table>
<tr><th>Session</th><th colspan="2">Session 5: How Creatures Adapt to Survive</th></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will be introduced to the work of wildlife biologists and begin to explore how adaptations help living things survive.
Learners will be enabled to
• Develop their understanding and appreciation of the work of wildlife biologists
• Understand how adaptations help living things survive
• Categorise, classify and explain animals adaptations</td></tr>
<tr><td>Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td></td><td>Science
Strand(s): Living things; Environmental awareness and care
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment
Concept(s): Adaptation; interdependence; ecosystems
Skill(s): Working scientifically (observing, sorting and classifying LEGO parts, identifying patterns in animal behaviour); Designing and making (planning and constructing the modular creature)

Mathematics
Strand(s): Data; Early mathematical activities.
Strand Unit(s): Recognising and interpreting data; Classifying.
Skill(s): Reasoning; Applying and problem-solving.

Geography
Strand(s): Natural environments; Environmental awareness and care
Strand Unit(s): The local natural environment; Environmental awareness
Concept(s): A sense of place; interrelationship of flora, fauna, and climate
Skill(s): Questioning; observing and investigating global versus local Irish habitats (e.g. comparing the Red Squirrel to rainforest species)

Visual Arts
Strand(s): Construction
Strand Unit(s): Making constructions
Concept(s): Awareness of form and space
Skill(s): Using 3D media (LEGO) to express ideas; choice of materials to represent physical traits like wings or specialised beaks

English (Language)
Strand(s): Oral Language; Writing
Element(s): Communicating; Understanding; Exploring and using language
Skill(s): Listening to and retelling animal survival stories; acquiring specialised vocabulary (e.g. adaptation, camouflage, mimicry, nocturnal); presenting findings as “Wildlife Biologists”

SPHE
Strand(s): Myself and others; Myself and the wider world
Strand Unit(s): Relating to others; Developing citizenship; Environmental care
Concept(s): Stewardship; social responsibility
Skill(s): Communication; co-operation; practising the Core Values of Teamwork and Inclusion while building in pairs</td><td>STEM Education

Strand(s): Nature of STEM
Strand Unit(s): STEM in our world
Element(s): Demonstrate an awareness of how learning about Living things connects to the wider field of Biology and other ‘Bio’ fields.
Skill(s): Connecting, identifying patterns, perspective-taking
Key Competencies: AC, AL, CL

Strand(s): Living things
Strand Unit(s): Animal life / Biodiversity
Element(s): Explore and investigate the interdependence of living things... how they adapt so they can survive and thrive.
Skill(s): Classifying, observing, identifying patterns, scientific questioning.
Key Competencies: AL, CL, M

Strand(s): Data and chance
Strand Unit(s): Data
Skill(s): Reasoning and Applying and problem solving; specifically sorting and classifying objects into sets based on their features as part of the progression continuum for exploring and interpreting data.
Key Competencies: M, AL, CL

Strand(s): Engineering
Strand Unit(s): User-focused design
Element(s): Systematically plan, make, test, and evaluate a design prototype to solve a problem (surviving a habitat)
Skill(s): Prototyping, making (constructing), iterating.
Key Competencies: AL, C, DL

Social and Environmental Education (SEE)

Strand(s): Europe and the wider world
Strand Unit(s): Environment and sustainable living
Element(s): Investigate, name and describe physical features of natural environments (biodiversity).
Skill(s): Investigating, interpreting, communicating.
Key Competencies: AC, AL, CL

Arts Education
Strand(s): Exploring and creating
Strand Unit(s): 3D Art (Construction)
Element(s): Explore, express and represent ideas and themes (adaptation) in a range of 2D and 3D art.
Skill(s): Constructing, designing, choice of materials and form.
Key Competencies: AL, CL, C

Language
Strand(s): Oral Language
Strand Unit(s) / Element(s): Communicating; Understanding; Exploring and usingLearning Outcome: Acquire subject-specific vocabulary to support comprehension; interact using increasingly sophisticated language.
Skill(s): Listening, speaking, discussing, presenting as “experts“.
Key Competencies: CL, AL

Wellbeing
Strand(s): Emotional and relational education
Strand Unit(s): Relationships
Element(s): Identify and apply key features of teamwork and co-operation.
Skill(s): Collaborating, cooperating, reflecting.
Key Competencies: W, AC, AL</td></tr>
</table>

Table 5e. BIOGLOW Curriculum Connections

Session	Session 6: How Bioacousticians use Sound Sensors	
Purpose and Learning Outcomes	Learners will explore the work of bioacousticians and how they use sound sensors. They will also develop an understanding of how sensors work through building, coding and adapting a LEGO project. *Learners will be enabled to* • Develop an understanding of, and appreciation for, how sound sensors can be used to detect rare and shy species that scientists cannot always see. • Build and code a LEGO robot. • Experiment with cause and effect relationships using the sensor blocks. • Develop a deeper understanding of code and computational thinking by testing and adapting prototypes.	
Curriculum Connections	**1999**	**2025**
	Science **Strand(s):** Living things; Energy and forces; Environmental awareness and care **Strand Unit(s):** Plant and animal life; Sound; Environmental awareness; Caring for the environment **Skill(s):** Working scientifically; Designing and making **Scientific Investigation Skills** (Questioning, Observing, Predicting, Investigating and experimenting, Analysing, Recording and communicating) **Geography** **Strand(s):** Natural environments; Environmental awareness and care **Strand Unit(s):** The local natural environment; Environmental awareness **Skill(s):** Working as a geographer **Geographical Investigation Skills** (Questioning, Hypothesising, Investigating, Observing, Analysing, Recording, Communicating how technology tracks wildlife) **Mathematics** **Strand(s):** Data **Strand Unit(s):** Representing and interpreting data **Skill(s): Applying and problem-solving** (programming the sensor to react to specific stimuli); **Communicating and expressing** (explaining how the code represents a rare species alert); **Reasoning**; **Implementing** **Visual Arts** **Strand(s):** Construction **Strand Unit(s):** Making constructions **Skill(s):** Choice of materials; Making constructions **Visual Arts Concepts** (An awareness of form, An awareness of space) **Music** **Strand(s):** Listening and responding **Strand Unit(s):** Exploring sounds **Skill(s):** Identifying a variety of sound sources in the environment (e.g. Irish wildlife calls); using electronic sounds to represent nature **Music Concepts** (An awareness of timbre (sound quality), An awareness of dynamics (loud/soft)) **Language (English)** **Strand(s):** Oral Language; Writing **Strand Unit(s):** Communicating; Understanding; Exploring and using language **Skill(s):** Listening; Speaking; Discussing; Acquiring specialised vocabulary (e.g. *bioacoustician, Passive Acoustic Monitor, algorithm, sensor*); Presenting findings to peers **SPHE** **Strand(s):** Myself and others; Myself and the wider world **Strand Unit(s):** Relating to others; Developing citizenship; Environmental care **Skill(s):** Communication; Co-operation; Decision-making; Practicing the Core Values of **Teamwork** and **Inclusion** while building and coding in pairs **SPHE Concepts** (Stewardship; Social responsibility)	**STEM Education** **Strand(s):** Living things **Strand Unit(s):** Biodiversity / Animal life **Skill(s):** Scientific questioning, observing, identifying patterns. **Key Competencies:** AL, CL, M **Strand(s):** Data and chance **Strand Unit(s):** Data **Skill(s): Representing** (using the 3x3 light matrix to create pixel images); **Connecting** (linking animal sounds to digital alerts); **Mathematising**. **Key Competencies:** M, AL, CL **Strand(s):** Nature of STEM **Strand Unit(s):** STEM in our world **Skill(s):** Connecting, identifying patterns, perspective-taking (acting as a Bioacoustician). **Key Competencies:** AL, DL, M **Strand(s):** Technology **Strand Unit(s):** Using technology / Creating with technology **Skill(s):** Identifying patterns, decomposing, sequencing (algorithmic thinking), debugging. **Key Competencies:** AL, C, DL **Strand(s):** Engineering **Strand Unit(s):** User-focused design **Skill(s):** Prototyping, testing, making (constructing), perspective-taking (designing research tools for shy species). **Key Competencies:** AL, C, DL **Social and Environmental Education (SEE)** **Strand(s):** Europe and the wider world **Strand Unit(s):** Environment and sustainable living **Skill(s):** Investigating, interpreting and analysing, using evidence to draw conclusions about environmental protection. **Key Competencies:** AC, AL, CL **Arts Education** **Strand(s):** Exploring and creating **Strand Unit(s):** 3D Art (Construction) **Skill(s):** Constructing, designing, and expressing scientific themes through 3D media. **Key Competencies:** AL, CL, C **Language** **Strand(s):** Oral Language **Strand Unit(s):** Communicating; Understanding; Exploring and using **Skill(s):** Listening, speaking, discussing, and explaining cause-and-effect relationships while acquiring technical vocabulary (e.g., *Passive Acoustic Monitor, sensor, algorithm*). **Key Competencies:** CL, AL **Wellbeing** **Strand(s):** Emotional and relational education **Strand Unit(s):** Relationships **Skill(s):** Collaborating, co-operating, and reflecting through teamwork during the building and coding phases. **Key Competencies:** W, AL, CL

Table 5f. BIOGLOW Curriculum Connections

<table>
<tr><td>Session</td><td colspan="2">Session 7: The Wildlife Biologist - Tasks and Tools</td></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will explore the work of wildlife biologists and the tools they use to understand how rare species live, interact, and survive. They will also explore how to build and code a LEGO Tree House and adapt it into an imaginary research observation station.

Learners will be enabled to

• Develop an understanding of, and appreciation for the work of wildlife biologists as in learning about rare species that live, interact and survive high up in the rainforest.
• Build and code a LEGO robot.
• Experiment with cause and effect relationships using the motor blocks.
• Develop a deeper understanding of code and computational thinking by testing and adapting prototypes.</td></tr>
<tr><td>Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td></td><td>Science
Strand(s): Living things; Energy and forces; Environmental awareness and care
Strand Unit(s): Plant and animal life; Sound; Environmental awareness; Caring for the environment
Skill(s): Working scientifically; Designing and making
Scientific Investigation Skills (Questioning, Observing, Identifying patterns in animal behaviour, Predicting, Investigating and experimenting, Analysing, Recording and communicating)
Concepts: Adaptation; interdependence; ecosystems; sound as a form of energy

Geography
Strand(s): Natural environments; Environmental awareness & care
Strand Unit(s): The local natural environment; Environmental awareness
Skill(s): Working as a geographer
Geographical Investigation Skills (Questioning; observing and investigating global versus local Irish habitats; investigating environmental issues such as non-invasive monitoring)
Concepts: A sense of place; a sense of space; interrelationship of flora, fauna, and climate

Music
Strand(s): Listening and responding
Strand Unit(s): Exploring sounds
Skill(s): Listening and Responding Skills (Identifying a variety of sound sources in the environment, such as Irish wildlife calls; using electronic sounds to represent nature)
Concepts: Awareness of timbre (sound quality) and dynamics (loud/soft)</td><td>STEM Education

Strand(s): Nature of STEM
Strand Unit(s): STEM in our world
Skill(s): Exploring and experiencing how people working in STEM carry out investigations and help to solve problems; perspective-taking.
Key Competencies: AL, DL, M

Strand(s): Living things
Strand Unit(s): Biodiversity / Animal life
Skill(s): Scientific questioning, investigating, observing, and identifying patterns in how science helps us understand rare and shy species.
Key Competencies: AL, CL, M

Strand(s): Technology
Strand Unit(s): Creating with technology / Using technology
Skill(s): Identifying patterns, decomposing, sequencing (algorithmic thinking), and debugging when programming the research device or tree house.
Key Competencies: AL, C, DL

Strand(s): Engineering
Strand Unit(s): User-focused design
Skill(s): Prototyping, making (constructing), testing, and evaluating a design prototype to solve the problem of non-invasive habitat research.
Key Competencies: AL, C, CL

Strand(s): Shape and space; Measures; Number.
Strand Unit(s): Spatial awareness and location; Shape; Measuring; Fractions.
Skill(s): Understanding and connecting (specifically classifying angles as acute, obtuse, straight or reflex as part of the progression continuum); Mathematising; Estimating and measuring (using precision tools like calipers); Applying and problem-solving.
Key Competencies: M, AL, CL, DL</td></tr>
</table>

Table 5g-i. BIOGLOW Curriculum Connections

Curriculum Connections	1999	2025
	Visual Arts **Strand(s):** Construction **Strand Unit(s):** Making constructions **Skill(s):** Making constructions (Using 3D media/ LEGO to express scientific ideas; choice of materials to represent research tools) **Concepts:** Awareness of form; awareness of space **English (Language)** **Strand(s):** Oral Language; Writing **Strand Unit(s):** Communicating; Understanding; Exploring and using language **Skill(s):** Receptive and Expressive Language Skills (Listening to and retelling animal survival stories; acquiring specialised vocabulary such as *bioacoustician, Passive Acoustic Monitor, algorithm, sensor*; presenting findings to peers) **Mathematics** **Strand(s):** Shape and space; Measures; Number. **Strand Unit(s):** Spatial awareness; Angles (acute, obtuse, and right angles); Length (measuring species data); Decimals (adjusting motor rotation increments). **Skill(s):** Applying and problem-solving; Communicating & expressing; Reasoning; Implementing; Understanding & recalling **SPHE** **Strand(s):** Myself and others; Myself and the wider world **Strand Unit(s):** Relating to others; Developing citizenship; Environmental care **Skill(s):** Communication; Co-operation; Decision-making; Practicing the Core Values of **Teamwork** and **Inclusion** while building and coding in pairs **SPHE Concepts** (Stewardship; Social responsibility	**Social and Environmental Education (SEE)** **Strand(s):** Europe and the wider world **Strand Unit(s):** Environment and sustainable living **Skill(s):** Questioning, investigating, and using evidence to draw conclusions about the protection of rainforest biodiversity. **Key Competencies:** AC, AL, CL **Arts Education** **Strand(s):** Exploring and creating; Performing and presenting; Responding and connecting **Strand Unit(s):** (Elements) Generate, perform, and record music using digital tools **Skill(s):** Improvising, composing (sound sequences), identifying environmental sound sources, and using digital tools. **Key Competencies:** AL, C, DL **Strand(s):** Exploring and creating **Strand Unit(s):** 3D Art (Construction) **Skill(s):** Constructing, designing, and expressing scientific themes through 3D media (LEGO). **Key Competencies:** AL, CL, C **LanguageStrand(s):** Oral Language **Strand Unit(s):** Communicating; Understanding; Exploring and using **Skill(s):** Listening, speaking, and discussing while acquiring technical vocabulary (e.g., *bioacoustician, sensor, algorithm*) and explaining cause-and-effect. **Key Competencies:** CL, AL **Wellbeing** **Strand(s):** Emotional and relational education **Strand Unit(s):** Relationships **Skill(s):** Identifying and applying key features of teamwork, co-operation, and reflection during collaborative building and coding tasks. **Key Competencies:** W, AL, CL

Table 5g-ii. BIOGLOW Curriculum Connections

<table>
<tr><td>Session</td><td colspan="2">Session 8: Wildlife Conservation</td></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will develop an understanding of wildlife conservation and why preservation and restoration are so important for biodiversity. They will also build and adapt a lifting platform which uses motors, sensors and outputs.

Learners will be enabled to

• Develop an understanding of wildlife conservation and why it is important for preserving, protecting and restoring biodiversity and ecosystems.

• Apply their understanding of motors, sensors and if/then statements while building, adapting and programming a lifting platform model.</td></tr>
<tr><td rowspan="2">Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td>Science
Strand(s): Living things; Environmental awareness and care
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment
Skill(s): Working scientifically Scientific Investigation Skills (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating) Designing and making (Exploring, Planning, Making, Evaluating the motorised lifting platform)
Concepts: Interdependence; adaptation; ecosystems; stewardship

Geography
Strand(s): Natural environments; Environmental awareness and care
Strand Unit(s): People and places in other areas (Rainforest vs. Local); The local natural environment; Environmental awareness; Caring for the environment
Skill(s): Working as a geographer Geographical Investigation Skills (Questioning, Hypothesising, Investigating, Observing, Analysing, Recording, Communicating how technology helps protect habitats)
Concepts: A sense of place; a sense of space; interrelationship of flora, fauna, and human activity

Visual Arts
Strand(s): Construction
Strand Unit(s): Making constructions
Skill(s): Making 3D constructions (using LEGO prototyping pieces to improve the Lifting Platform); Choice of materials; Looking and responding
Concepts: Awareness of line, form, and space

English (Language)
Strand(s): Oral Language; Writing
Strand Unit(s): Communicating; Understanding; Exploring and using language
Skill(s): Listening; Speaking; Discussing; Acquiring specialised vocabulary (e.g., conservation, ecologist, impact, motorise); Presenting team solutions</td><td>STEM Education

Strand(s): Nature of STEM
Strand Unit(s): STEM in our world
Skill(s): Exploring and experiencing how people in STEM carry out investigations and solve problems, perspective-taking.
Key Competencies: AL, DL, M

Strand(s): Living things
Strand Unit(s): Biodiversity / Animal life
Skill(s): Questioning, observing, identifying patterns, scientific investigation.
Key Competencies: AC, AL, CL

Strand(s): Engineering
Strand Unit(s): User-focused design
Skill(s): Systematically planning, making, testing, and evaluating a design prototype to solve a specific environmental or conservation problem.
Key Competencies: AL, C, CL

Strand(s): Technology
Strand Unit(s): Creating with technology / Using technology
Skill(s): Identifying patterns, sequencing (algorithmic thinking), debugging, and exploring how inputs, processes, and outputs work together to solve problems.
Key Competencies: AL, C, DL

Strand(s): Shape and space; Algebra. Strand Unit(s): Spatial awareness and location; Shape; Patterns, rules and relationships.
Skill(s): Understanding and connecting (identifying and classifying angles; describing vertical, horizontal, perpendicular, and parallel lines during the construction of the platform); Reasoning (using logic to make and justify conjectures about if/then coding statements); Representing.
Key Competencies: M, AL, CL</td></tr>
</table>

Table 5h-i. BIOGLOW Curriculum Connections

Curriculum Connections	1999	2025
	SPHE **Strand(s):** Myself and the wider world **Strand Unit(s):** Developing citizenship; Environmental care **Skill(s):** Communication; Co-operation; Decision-making; Practicing the Core Values of **Teamwork, Discovery, Fun,** and **Impact** while solving conservation problems **Concepts:** Social responsibility; stewardship; being custodians of the Earth **History** **Strand(s):** Continuity and change over time **Strand Unit(s):** My locality through the ages; Environmental change **Skill(s):** *Working as an historian* Historical Investigation Skills (Questioning, Observing, using evidence to understand how habitats have changed over time) **Concepts:** Cause and effect (impact of human activity on biodiversity) **Mathematics** **Strand(s):** Shape and space; Algebra. **Strand Unit(s):** 2-D shapes; 3-D shapes; Lines and angles; Number patterns and sequences. **Skill(s): Applying and problem-solving** (designing a stable structure for the lifting arm); **Reasoning** (investigating relationships between the angle of the lift and the height reached); **Communicating and expressing** (using mathematical language to describe the platform's movement)	**Social and Environmental Education (SEE)** **Strand(s):** Europe and the wider world **Strand Unit(s):** Environment and sustainable living **Skill(s):** Questioning, investigating, and identifying opportunities to protect natural environments. **Key Competencies:** AC, AL, CL **Arts Education - Visual Arts** **Strand(s):** Exploring and creating **Strand Unit(s):** 3D Art (Construction) **Skill(s):** Constructing, designing, expressing themes through media, and choosing materials to represent scientific tools or habitats. **Key Competencies:** AL, CL, C **Language - English** **Strand(s):** Oral Language **Strand Unit(s):** Communicating; Understanding; Exploring and using **Skill(s):** Acquiring subject-specific vocabulary to support comprehension (e.g., *conservation, ecologist*); interacting using increasingly sophisticated language. **Key Competencies:** CL, AL **Wellbeing - SPHE** **Strand(s):** Community and belonging **Strand Unit(s):** Citizenship **Skill(s):** Identifying and proposing actions to address broader environmental concerns to promote collective wellbeing. **Key Competencies:** W, AC, AL

Table 5h-ii. BIOGLOW Curriculum Connections

<table>
<tr><td>Session</td><td colspan="2">Session 9: Citizen Science - Using Sensors to Protect Biodiversity</td></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will consider how technology (e.g., sensors) can act as our “eyes and ears” to monitor and protect local biodiversity. They will develop an initial awareness of how collecting and analysing environmental data can help us to protect biodiversity.

Learners will be enabled to

• Identify how wildlife scientists use technology to monitor and protect biodiversity.
• Describe what Citizen Science is and explain how regular citizens contribute to global and local scientific databases.
• Understand how the National Biodiversity Data Centre (NBDC) uses species sightings to protect Irish wildlife through citizen science projects, that often benefit from technology
• Apply their understanding of sensors and if/then statements while building, adapting and programming a research tool prototype.</td></tr>
<tr><td rowspan="2">Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td>Science
Strand(s): Living things; Environmental awareness and care
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment
Skill(s): Working scientifically; Designing and making
Scientific Investigation Skills: (Questioning, Observing, Predicting, Investigating and experimenting, Analysing, Sorting and classifying, Recognising patterns, Interpreting, Recording and communicating)
Concepts: Interdependence; adaptation; ecosystems; stewardship

Mathematics
Strand(s): Data; Shape and space
Strand Unit(s): Representing and interpreting data; Spatial awareness; 2-D shapes; 3-D shapes
Skill(s): Applying and problem-solving (logging the what, where, and when of species sightings); Communicating and expressing (interpreting migration maps and GPS data); Reasoning; Integrating and connecting (exploring how technology helps people record and protect biodiversity).

Geography
Strand(s): Natural environments; Environmental awareness and care
Strand Unit(s): The local natural environment; Environmental awareness; Caring for the environment
Skill(s): Working as a geographer
Geographical Investigation Skills: (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating species data to the NBDC)
Concepts: A sense of place; a sense of space; interrelationship of flora, fauna, and human activity

History
Strand(s): Continuity and change over time
Strand Unit(s): My locality through the ages; Environmental change
Skill(s): Working as an historian
Historical Investigation Skills: (Questioning, Observing, Inferencing, Hypothesising, Investigating, Analysing, Drawing evidence-based conclusions, Recording and Communicating how local biodiversity has changed over time)
Concepts: Cause and effect (human impact on Ireland’s natural heritage); Change and continuity</td><td>STEM Education

Strand(s): Living things
Strand Unit(s): Biodiversity / Animal life
Skill(s): Scientific questioning, investigating, observing, and identifying patterns in how science can solve biodiversity-related problems.
Key Competencies: AC, AL, CL

Strand(s): Nature of STEM
Strand Unit(s): STEM in our world
Skill(s): Exploring and experiencing how people working in STEM (such as NBDC researchers) carry out investigations and help to solve environmental problems.
Key Competencies: AL, DL, M

Strand(s):Technology
Strand Unit(s): Using technology / Creating with technology
Skill(s): Identifying patterns, sequencing (using “if/then” statements for the research tool), and exploring how inputs and outputs work together.
Key Competencies: AL, C, DL

Strand(s): Engineering
Strand Unit(s): User-focused design / Knowledge of design process
Skill(s): Prototyping, making (constructing), testing, and evaluating a research device prototype to solve a real-world data collection challenge.
Key Competencies: AL, C, CL

Strand(s): Data and chance; Shape and space
Strand Unit(s): Data; Spatial awareness and location; Shape
Skill(s): Representing (collecting and logging species sightings); Connecting (linking location data to migration patterns); Applying and problem-solving (specifically recording movement from one location to another using a simple map to track the journey of the cuckoo); Reasoning.
Key Competencies: M, DL, AL</td></tr>
</table>

Table 5i-i. BIOGLOW Curriculum Connections

Curriculum Connections	1999	2025
	Visual Arts **Strand(s):** Construction **Strand Unit(s):** Making constructions (building the LEGO research device) **Skill(s):** Making 3D constructions; Choice of materials; Looking and responding **Concepts:** Awareness of form; awareness of space **Language** **Strand(s):** Oral Language; Writing **Strand Unit(s):** Communicating; Understanding; Exploring and using language **Skill(s):** Listening; Speaking; Discussing; Acquiring specialised vocabulary (e.g., *citizen science, data capture, biodiversity, NBDC*); Presenting research findings **SPHE** **Strand(s):** Myself and the wider world **Strand Unit(s):** Developing citizenship; Environmental care **Skill(s):** Communication; Co-operation; Decision-making; Practicing stewardship through Citizen Science participation **Concepts:** Social responsibility; being custodians of the Earth; individual and community responsibility for the environment	**Social and Environmental Education (SEE)** **Strand:** Environment and sustainable living **Strand Unit(s):** Environment and sustainable living **Skill(s):** Investigating physical features of the natural environment (biodiversity) and identifying opportunities to become involved in protecting them through citizen science. **Key Competencies:** AC, AL, CL **Arts Education** **Strand(s):** Exploring and creating **Strand Unit(s):** 3D Art (Construction) **Skill(s):** Designing and representing scientific themes and habitats in a range of 3D media. **Key Competencies:** AL, CL, C **Language** **Strand(s):** Oral Language **Strand Unit(s):** Communicating; Understanding; Exploring and using **Skill(s):** Acquiring and using subject-specific vocabulary (e.g., *citizen science, data capture, sensors*) to support comprehension and interaction. **Key Competencies:** CL, AL **Wellbeing** **Strand(s):** Community and belonging **Strand Unit(s):** Citizenship **Skill(s):** Identifying ways to take responsibility and contribute to the school and community through stewardship and proposed actions for collective wellbeing. **Key Competencies:** W, AC, AL

Table 5i-ii. BIOGLOW Curriculum Connections

<table>
<tr><th>Session</th><th colspan="2">Session 10</th></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will work in teams to create their Team Model and Poster, which shares what they have learned about biodiversity, and demonstrates an understanding of the work of scientists and the technology used to study and protect nature.

Learners will be enabled to

• Demonstrate knowledge and understanding of biodiversity, healthy ecosystems, and the work of scientists and the technology used to study and protect nature.
• Work collaboratively to build and code a Team Model sharing what they have learned about biodiversity.
• Collaboratively design and label the Team Model.
• Work collaboratively to plan and design a Team Poster which describes the team's learning throughout the sessions and supports the Team Model.
• Communicate the purpose of the Team Model.</td></tr>
<tr><td>Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td></td><td>Mathematics
Strand(s): Shape and space; Measures
Strand Unit(s): 2-D/3-D shapes; Time
Skill(s): Applying and problem-solving; Communicating and expressing; Integrating and connecting; Reasoning; Implementing

Science
Strand(s): Living things; Environmental awareness and care
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment
Skill(s): Working scientifically; Designing and making
Scientific Investigation Skills: (Questioning, Observing, Predicting, Investigating and experimenting, Analysing, Sorting and classifying, Recognising patterns, Interpreting, Recording and communicating)
Concepts: Interdependence; adaptation; ecosystems; stewardship

Geography
Strand(s): Natural environments; Environmental awareness and care
Strand Unit(s): The local natural environment; Environmental awareness; Caring for the environment
Skill(s): Working as a geographer
Geographical Investigation Skills: (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating species data to the NBDC)
Concepts: A sense of place; a sense of space; interrelationship of flora, fauna, and human activity

Literacy
Strand(s): Oral Language; Writing
Strand Unit(s): Communicating
Skill(s): Communicating; Understanding; Exploring and using

Visual Arts
Strand(s): Construction; Drawing
Strand Unit(s): Making constructions; Making drawings
Skill(s): An awareness of line; An awareness of form; An awareness of space

SPHE
Strand(s): Myself and others;Myself and the wider world
Strand Unit(s): My friends and other people; Relating to others; Developing citizenship
Skill(s): Communication; Cooperation; Decision-making</td><td>STEM Education

Strand(s): Nature of STEM

Strand Unit(s): STEM in our world / How STEM works
Skill(s): Perspective-taking (acting as scientists/engineers), exploring STEM careers, and investigating how STEM is infused within society.
Key Competencies: AC, AL, DL

Strand(s): Living things
Strand Unit(s): Biodiversity / Animal life / Plant life
Skill(s): Investigating, observing, identifying patterns, and scientific questioning.
Key Competencies: AC, AL, CL

Strand(s): Technology
Strand Unit(s): Understanding technology / Using technology / Creating with technology
Skill(s): Decomposing, sequencing (algorithmic thinking), debugging, and exploring how inputs, processes, and outputs work together.
Key Competencies: AL, C, DL

Strand(s): Engineering
Strand Unit(s): User-focused design / Knowledge of design process
Skill(s): Prototyping, making (constructing), testing, iterating, and using empathy to identify and solve design problems.
Key Competencies: AL, C, CL

Strand(s): Shape and space; Measures
Strand Unit(s): Shape; Time
Skill(s): Understanding and connecting; Communicating; Reasoning; Applying and problem-solving
Key Competencies: M, AL, CL

Social and Environmental Education (SEE)

Strand(s): My locality / Europe and the wider world
Strand Unit(s): Environment and sustainable living / People and places
Skill(s): Investigating, interpreting and analysing, and communicating findings about natural environments and biodiversity.
Key Competencies: AC, AL, CL

Arts Education
Strand(s): Exploring and creating
Strand Unit(s): 3D Art (Construction) / Drawing
Skill(s): Constructing, designing, choosing tools and materials, and expressing scientific themes through 3D media and 2D poster design.
Key Competencies: AL, CL, C

Language
Strand(s): Oral Language / Writing
Strand Unit(s): Communicating; Understanding; Exploring and using
Skill(s): Acquiring sophisticated vocabulary, creating multimodal texts (poster), and interacting with team members and audiences.
Key Competencies: CL, AL

Wellbeing
Strand(s): Community and belonging / Emotional and relational education
Strand Unit(s): Citizenship / Relationships
Skill(s): Collaborating, co-operating, identifying features of teamwork, and proposing actions to address environmental concerns.
Key Competencies: W, AC, AL</td></tr>
</table>

Table 5j. BIOGLOW Curriculum Connections

Session	Session 11	
Purpose and Learning Outcomes	Learners will prepare to share their BIOGLOW project (including the poster and model) at a showcase event. *Learners will be enabled to* • Communicate the purpose of their Team Model and Poster at a Final Celebration Event - learners share their knowledge of biodiversity, ecosystems, and the real-world technology scientists use to study and protect nature. • Discuss their knowledge and understanding of the BIOGLOW theme.	
Curriculum Connections	**1999**	**2025**
	Science **Strand(s):** Living things; Environmental awareness and care **Strand Unit(s):** Plant and animal life; Environmental awareness; Caring for the environment **Skill(s):** Working scientifically; Designing and making **Scientific Investigation Skills:** (Questioning, Observing, Predicting, Investigating and experimenting, Analysing, Sorting and classifying, Recognising patterns, Interpreting, Recording and communicating) **Concepts:** Interdependence; adaptation; ecosystems; stewardship **Geography** **Strand(s):** Natural environments; Environmental awareness and care **Strand Unit(s):** The local natural environment; Environmental awareness; Caring for the environment **Skill(s):** Working as a geographer **Geographical Investigation Skills:** (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating species data to the NBDC) **Concepts:** A sense of place; a sense of space; interrelationship of flora, fauna, and human activity **Literacy** **Strand(s)**: Oral Language; Writing **Strand Unit(s):** Communicating **Skill(s):** Communicating; Understanding; Exploring and using **Visual Arts** **Strand(s):** Construction; Drawing **Strand Unit(s):** Making constructions; Making drawings **Skill(s):** An awareness of line; An awareness of form; An awareness of space **SPHE** **Strand(s):** Myself and others;Myself and the wider world **Strand Unit(s):** My friends and other people; Relating to others; Developing citizenship **Skill(s):** Communication; Cooperation; Decision-making	**STEM Education** **Strand(s):** Nature of STEM **Strand Unit(s):** STEM in our world **Skill(s):** Exploring and experiencing how people working in STEM carry out investigations and solve problems; communicating discoveries to an audience. **Key Competencies:** AL, DL, M **Strand(s):** Technology **Strand Unit(s):** Using technology / Creating with technology **Skill(s):** Explaining and sharing understanding of how technology was used to solve problems; evaluating and sharing reflections on the digital process. **Key Competencies:** AL, C, DL **Strand(s):** Engineering **Strand Unit(s):** Knowledge of design process **Skill(s):** Drawing conclusions and presenting an analysis of the iterative design process; evaluating the effectiveness of the team model solution. **Key Competencies:** AL, C, DL **Strand(s):** Living things **Strand Unit(s):** Biodiversity / Animal life **Skill(s):** Evaluating and communicating scientific findings; justifying pathways and drawing conclusions from evidence gathered during the project. **Key Competencies:** AC, AL, CL **Social and Environmental Education (SEE)** **Strand(s):** My locality / Europe and the wider world **Strand Unit(s):** Environment and sustainable living **Skill(s):** Communicating: conveying information, ideas, and interpretations related to environmental inquiries using a variety of media (poster and model). **Key Competencies:** AC, AL, CL **Arts Education** **Strand(s):** Performing and presenting **Strand Unit(s):** Art, Drama, Music and other artforms **Skill(s):** Organising, structuring, and sharing work in impactful ways; evaluating personal and collaborative arts-making through the project showcase. **Key Competencies:** AL, CL, W **Language** **Strand(s):** Oral Language **Strand Unit(s):** Communicating; Understanding; Exploring and using **Skill(s):** Supplying, explaining, and justifying points of information to familiar and unfamiliar audiences (judges/parents) using project-specific language. **Key Competencies:** CL, AL **Wellbeing** **Strand(s):** Community and belonging / Emotional and relational education **Strand Unit(s):** Citizenship / Relationships **Skill(s):** Embodying key features of teamwork and co-operation through participation in the event; proposing actions to address biodiversity concerns to the community. **Key Competencies:** W, AC, AL

Table 5k. BIOGLOW Curriculum Connections

<table>
<tr><td>Session</td><td colspan="2">Session 12</td></tr>
<tr><td>Purpose and Learning Outcomes</td><td colspan="2">Learners will reflect upon their Team Model and Poster, their understanding of biodiversity and ecosystems, and their appreciation for the work of scientists and the real-world technology use to study and protect nature.

Learners will be enabled to

• Describe their team's journey throughout the BIOGLOW sessions.

• Discuss their knowledge and understanding of the BIOGLOW theme.</td></tr>
<tr><td>Curriculum Connections</td><td>1999</td><td>2025</td></tr>
<tr><td></td><td>Science
Strand(s): Living things; Environmental awareness and care
Strand Unit(s): Plant and animal life; Environmental awareness; Caring for the environment
Skill(s): Working scientifically; Designing and making
Scientific Investigation Skills: (Questioning, Observing, Predicting, Investigating and experimenting, Analysing, Sorting and classifying, Recognising patterns, Interpreting, Recording and communicating)
Concepts: Interdependence; adaptation; ecosystems; stewardship

Geography
Strand(s): Natural environments; Environmental awareness and care
Strand Unit(s): The local natural environment; Environmental awareness; Caring for the environment
Skill(s): Working as a geographer
Geographical Investigation Skills: (Questioning, Observing, Predicting, Investigating and experimenting, Estimating and measuring, Analysing, Recording and communicating species data to the NBDC)
Concepts: A sense of place; a sense of space; interrelationship of flora, fauna, and human activity

Literacy
Strand(s): Oral Language; Writing
Strand Unit(s): Communicating
Skill(s): Communicating; Understanding; Exploring and using

Visual Arts
Strand(s): Construction; Drawing
Strand Unit(s): Making constructions; Making drawings
Skill(s): An awareness of line; An awareness of form; An awareness of space
SPHE
Strand(s): Myself and others;Myself and the wider world
Strand Unit(s): My friends and other people; Relating to others; Developing citizenship
Skill(s): Communication; Cooperation; Decision-making</td><td>STEM Education

Strand(s): Nature of STEM
Strand Unit(s): STEM in our world
Skill(s): Connecting learning to STEM careers, perspective-taking (acting as scientists), and investigating how STEM is infused in society.
Key Competencies: AL, DL, M

Strand(s): Living things
Strand Unit(s): Biodiversity / Animal life
Skill(s): Evaluating scientific findings, drawing conclusions from evidence, and identifying patterns in how science solves biodiversity problems.
Key Competencies: AC, AL, CL

Strand: Technology
Strand Unit(s): Understanding technology / Using technology
Skill(s): Presenting data, evaluating and sharing reflections on the digital process, and identifying how technologies help society.
Key Competencies: AL, C, DL

Strand(s): Engineering
Strand Unit(s): Knowledge of design process
Skill(s): Drawing conclusions, presenting an analysis of the iterative design process, and reflecting on user-needs and prototype effectiveness.
Key Competencies: AL, C, DL

Social and Environmental Education (SEE)

Strand(s): My locality / Europe and the wider world
Strand Unit(s): Environment and sustainable living
Skill(s): Interpreting and analysing evidence, questioning environmental impacts, and communicating findings about biodiversity protection.
Key Competencies: AC, AL, CL

Arts Education
Strand(s): Performing and presenting; Responding and connecting
Strand Unit(s): Art, Drama, Music and other artforms
Skill(s): Reflecting upon, discussing, and evaluating personal and collaborative arts-making through the project showcase.
Key Competencies: AL, CL, W

Language
Strand(s): Oral Language
Strand Unit(s): Communicating; Understanding; Exploring and using
Skill(s): Interacting using sophisticated subject-specific language to demonstrate and celebrate what has been learned during the project.
Key Competencies: CL, AL, C

Wellbeing
Strand(s): Emotional and relational education / Community and belonging
Strand Unit(s): Resilience / Relationships / Citizenship
Skill(s): Reflecting on the personal relevance of the learning journey, identifying features of successful teamwork, and proposing actions for environmental concerns.
Key Competencies: W, AC, AL</td></tr>
</table>

Table 5l. BIOGLOW Curriculum Connections

Digital Learning Framework (DLF) and School Self-Evaluation (SSE) connections

As part of the process in writing a digital learning plan, schools should firstly familiarise themselves with the Digital Learning Framework (DLF). Having reviewed the domains and standards, the school should identify the standard or standards on which it wishes to focus. This could be **one standard**, but not more than three. In some instances a school might identify one standard from the Teaching & Learning Dimension, and one standard from the Leadership & Management Dimension. For each standard there are a number of statements of effective practice and highly effective practice.

This BIOGLOW Teacher Guide will only refer to statements of effective practice, however a school may feel the statement of highly effective practice is more suitable to their context.

For further information on the Digital Learning Framework and the process of completing a Digital Learning Plan for your school visit **dlplanning.ie**. The **Digital Learning Planning Guidelines book** is a very useful guide in creating a Digital Learning Plan.

Tables 6 and 7 give an overview of the connections between BIOGLOW and the DLF and SSE.

For a school beginning to use a LEGO Education Set and *FIRST* LEGO League Explore for the first time, one or two of the following standards and statements could be considered when preparing your Digital Learning Plan:

	Teaching and Learning	
Subject	**Detail from DLF**	**Guidance**
Pupil	**Domain 1:** Learner Outcomes **Standard:** Pupils enjoy their learning, are motivated to learn and expect to achieve as learners. **Statement:** Pupils use appropriate digital technologies to foster active engagement in attaining appropriate learning outcomes.	Through engagement with BIOGLOW, pupils will use appropriate digital technologies (e.g. LEGO Education materials & digital devices etc.) to actively explore the 'challenge question' and create Team Models.
	Domain 1: Learner Outcomes **Standard:** Pupils enjoy their learning, are motivated to learn and expect to achieve as learners. **Statement:** Pupils use digital technologies to collect evidence and record progress.	Pupils will use digital devices and a portfolio tool to document the engineering design process while exploring the challenge question in BIOGLOW.
Teacher	**Domain 3:** Teachers' Individual Practice **Standard:** The teacher selects and uses planning, preparation and assessment practices that progress pupils' learning. **Statement:** Teachers use appropriate digital technologies to design complex, real-world problems and structure them in a way that incorporates key subject matter concepts.	Teachers adapt and use the BIOGLOW learning activities in order to provide pupils with complex, real-world problems which incorporate key subject matter concepts.

Table 6. Connections between BIOGLOW and the DLF and SSE.

For schools who have previously engaged with a LEGO Education Set or *FIRST* LEGO League resources, or schools who would like to take a different focus within their DL plan, the following section identifies several standards which could be met through participating in *FIRST* LEGO League Explore.

Remember, in order for the DL plan to be achievable, a school should ideally only select one/two standard(s) in a given DL planning cycle.

	Teaching and Learning	
	Detail from DLF	**Guidance**
DOMAIN 1	**Domain 1:** Learner Outcomes **Standard:** Pupils enjoy their learning, are motivated to learn and expect to achieve as learners. **Statement:** Pupils use appropriate digital technologies to foster active engagement in attaining appropriate learning outcomes.	Through engagement with *FIRST* LEGO League Explore, pupils will use appropriate digital technologies (e.g. LEGO Education materials & digital devices etc.) to actively explore the 'challenge question' and create Team Models.
	Domain 1: Learner Outcomes **Standard:** Pupils enjoy their learning, are motivated to learn and expect to achieve as learners. **Statement:** Pupils use digital technologies to collect evidence and record progress.	Pupils will use digital devices and a portfolio tool to document the engineering design process while exploring the challenge question in BIOGLOW.
	Domain 1: Learner Outcomes **Standard:** Pupils demonstrate the knowledge, skills and understanding required by the primary curriculum **Statement:** Pupils can use a range of digital technologies to demonstrate the knowledge, skills and understanding required by the Primary School Curriculum.	Through engagement with the BIOGLOW challenge question, pupils will use a range of digital technologies (e.g. LEGO Education materials & digital devices etc.) to demonstrate knowledge, skills and understanding in the form of Team Models, Team Posters and other tasks included in BIOGLOW.
	Domain 1: Learner Outcomes **Standard:** Pupils demonstrate the knowledge, skills and understanding required by the primary curriculum **Statement:** Pupils use digital technologies effectively to develop their knowledge, skills and understanding in accordance with the content objectives, learning outcomes, skills and concepts of the Primary School Curriculum.	Pupils develop their knowledge, skills and understandings through engagement with the BIOGLOW challenge question; specifically through the Engineering Design Process, in designing and building Team Models and in preparing a Team Poster.
DOMAIN 2	**Domain 2:** Learner Experiences **Standard:** Pupils engage purposefully in meaningful learning activities **Statement:** Pupils use digital technologies for sourcing and exchanging information to develop understanding and support basic knowledge creation.	While engaging with the BIOGLOW challenge question and tasks, pupils use digital technologies for sourcing, exchanging of information to develop understanding and support the creation of their Team Model and Team Poster.
	Domain 2: Learner Experiences **Standard:** Pupils reflect on their progress as learners and develop a sense of ownership of and responsibility for their learning **Statement:** Pupils use digital technologies to collect evidence, record and reflect on their progress, and develop their competence as self-directed learners.	The BIOGLOW challenge question and focus on Engineering Design Process enable pupils to engage in self-directed learning activities which involve the collection, recording and reflection on their projects, including Team Models and Team Posters.

	Teaching and Learning	
	Detail from DLF	**Guidance**
DOMAIN 3	**Domain 3:** Teachers' Individual Practice **Standard:** The teacher has the requisite subject knowledge, pedagogical knowledge and classroom management skills **Statement:** Teachers design or adapt learning experiences that incorporate digital technologies and make learning activities relevant and meaningful to support pupils' learning.	Teachers adapt and differentiate the BIOGLOW learning activities which incorporate digital technologies (e.g. LEGO Education materials & digital devices etc.) to support pupils' learning.
	Domain 3: Teachers' Individual Practice **Standard:** The teacher selects and uses planning, preparation and assessment practices that progress pupils' learning **Statement:** Teachers use appropriate digital technologies to design complex, real-world problems and structure them in a way that incorporates key subject matter concepts.	Teachers adapt and use the BIOGLOW learning activities in order to provide pupils with complex, real-world problems which incorporate key subject matter concepts.
DOMAIN 4	**Domain 4:** Teachers' Collaborative Practice **Standard:** Teachers value and engage in professional development and professional collaboration **Statement:** Teachers engage in professional development and work with colleagues to help them select and align digital technologies with effective teaching strategies to expand learning opportunities for all pupils	Teachers engage with professional learning opportunities (e.g. DCU/Creative HUT/Oide) in order to develop confidence and competence in making use of the LEGO SPIKE Essential and *FIRST* LEGO League resources to design learning opportunities for all pupils.
	Domain 4: Teachers' Collaborative Practice **Standard:** Teachers work together to devise learning opportunities for pupils across and beyond the curriculum **Statement:** Teachers participate in professional online communities to help them design learning opportunities for pupils across and beyond the curriculum.	Teachers engage with outside agencies (e.g. DCU/Creative HUT/Oide) in order to develop confidence and competence in making use of the LEGO SPIKE Essential and *FIRST* LEGO League resources to design learning opportunities for pupils across and beyond the curriculum.
	Domain 4: Teachers' Collaborative Practice **Standard:** Teachers contribute to building whole-staff capacity by sharing their expertise **Statement:** Teachers collaborate in determining how digital technologies can be used effectively for teaching, learning and assessment (TLA).	Teachers collaborate to discuss and determine how the BIOGLOW resources and equipment can be used effectively for teaching, learning and assessment.

Table 7a. Connections between BIOGLOW and the DLF and SSE.

Leadership and Management		
Detail from DLF	**Guidance**	
Domain 1: Leading Learning and Teaching **Standard:** Promote a culture of improvement, collaboration, innovation and creativity in learning, teaching, and assessment **Statement:** The principal and other leaders in the school encourage teachers to use digital technologies to enhance their learning, teaching and assessment practices, and to share their practice.	School leaders actively encourage and support teachers in their use of BIOGLOW with pupils. Teachers are encouraged and facilitated to share their BIOGLOW practice with colleagues.	DOMAIN 1
Domain 1: Leading Learning and Teaching **Standard:** Manage the planning and implementation of the curriculum **Statements:** The principal and other leaders in the school plan for and implement a broad and balanced curriculum using digital technologies that offer new opportunities for learning. They are committed to ensuring that the school curriculum is implemented in a way that provides valuable learning experiences designed to exploit the potential of digital technologies.	School leaders plan to implement BIOGLOW in order to provide valuable learning experiences which both exploit the potential of digital technologies and facilitate a broad and balanced curriculum with new opportunities for thematic teaching.	
Domain 1: Leading Learning and Teaching **Standard:** Foster teacher professional development that enriches teachers' and pupils' learning **Statement:** The principal and other leaders in the school support teachers' continuing professional development to develop teacher competence in the use of digital technologies, to support high-quality teaching and learning.	Teachers are encouraged and supported to engage with professional development which supports their engagement with BIOGLOW.	
Domain 2: Managing the Organisation **Standard:** Manage the school's human, physical and financial resources so as to create and maintain a learning organisation **Statements:** The board of management ensures the provision and maintenance of digital teaching aids and equipment to a good standard. Physical learning spaces have been designed or adapted to harness and optimise the use of a range of digital technologies for learning.	All required digital technologies (e.g. LEGO Education materials & digital devices etc.) are available to the teacher and pupils. Considerations are made to the maintenance of this equipment. Considerations are made to the layout of the classroom/multi-purpose space to best facilitate the Engineering Design Process and engagement with the BIOGLOW learning activities.	DOMAIN 2
Domain 3: Leading School Development **Standard:** Manage, lead and mediate change to respond to the evolving needs of the school and to changes in education **Statement:** The principal and other leaders in the school are informed by national policy and technological developments, and see their relevance to the school.	School leaders support and encourage teachers in use of BIOGLOW due to its clear alignment with policy and relevance to the school.	DOMAIN 3
Domain 4: Developing Leadership Capacity **Standard:** Empower staff to take on and carry out leadership roles **Statements:** The principal and other leaders in the school encourage teachers to take on leadership roles and to lead the use of digital technologies for learning, teaching and assessment, and are willing to distribute significant leadership responsibilities. They develop organisational structures to facilitate and encourage the sharing of practice and peer mentoring in the use of digital technologies for learning, teaching & assessment.	School leaders encourage teachers to participate in BIOGLOW. Teachers are then facilitated to share their experiences and expertise with colleagues in order to enable another teacher and class to participate in BIOGLOW.	DOMAIN 4

Table 7b. Connections between BIOGLOW and the DLF and SSE.

What Does the Team Need?

LEGO® Education Set

The LEGO® Education SPIKE™ Essential set, with its motor, sensor, and hub, is the set referenced throughout the sessions in this guide.

Note: This program and sessions are designed for use with SPIKE Essential. Other LEGO Education sets are allowed, but specific instructions may vary.



Electronic Device



Your team will need at least one compatible Bluetooth-enabled device like a laptop, tablet, or computer to run the LEGO® Education SPIKE™ app.

Scan the QR code to view system requirements and download the SPIKE app.

Engineering Notebooks

Each team member needs their own *Engineering Notebook* to record their ideas and progress. The *Engineering Notebook* contains session tasks, jobs and technology, and relevant information to guide teams through the sessions.



Team Poster Supplies

Each team will need a poster board and various art supplies in Sessions 10 to complete their team poster. These supplies can also be used in earlier sessions to record team progress.



BIOGLOW™ Explore Set

Each team will need one Explore Set, which includes the Explore models, mat, building instructions, and prototyping pieces.

Leave the LEGO pieces in their numbered bags until the team reaches the sessions that need them.



Note: a table showing the book and bag numbers for the models in the Explore set can be found on page 31.



Organisation of Team

Learners will work together in teams of four to six using elements from a LEGO Education set and an BIOGLOW Explore Set. They will collaborate and communicate to build, learn, and play together. Please refer to Figure 7 below for details of Team Roles. Learners should remain in the same teams for all sessions.

Team Roles

Here are sample team roles to use during the sessions. Everyone could experience each role multiple times throughout their *FIRST* LEGO League Explore experience.

Using roles helps the team function more efficiently and ensures that everyone on the team is engaged. Some roles, like the builder and coder, could be filled by multiple children during a session when the experience is designed for a pair of children.

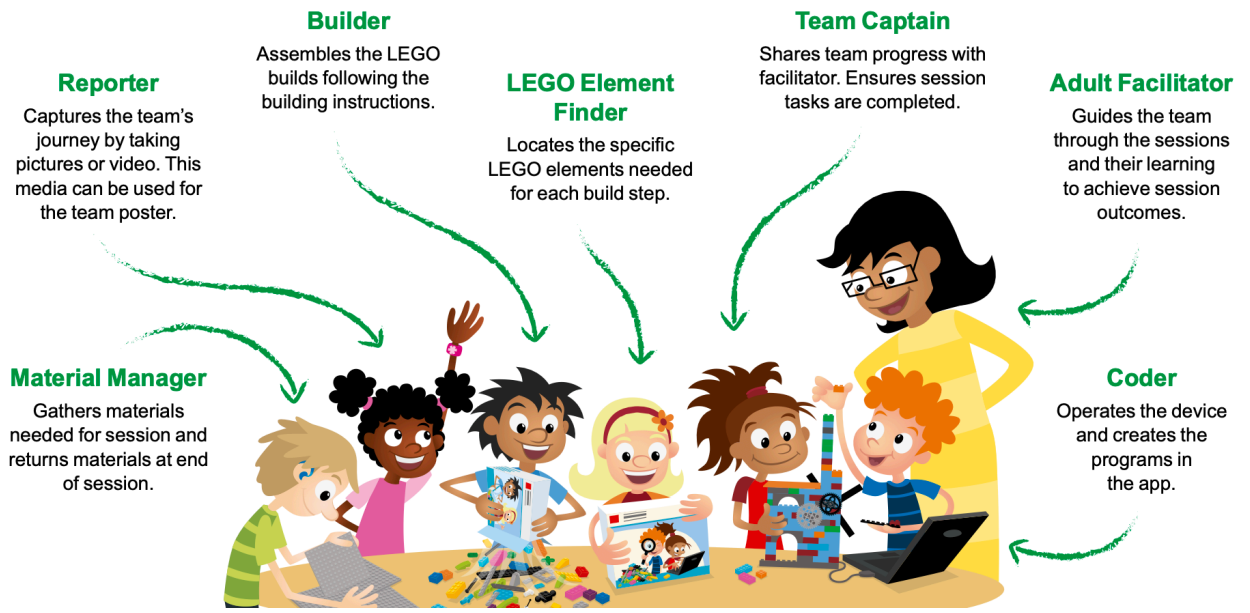


Figure 7. Team Roles

Engaging with experts

The following table outlines various opportunities for schools and teachers to engage with biodiversity experts, access specialised educational resources, and participate in national citizen science projects.



Biodiversity Engagement and Support for Irish Schools		
Organisation / Initiative	**Opportunities & Resources for Schools**	**Contact Details / Weblink**
Heritage in Schools	Provides experts (like Éanna Ní Lamhna) who visit classrooms to lead hands-on nature activities and field trips.	heritageinschools.ie
Dublin Zoo	Offers curriculum-linked workshops, on-site school tours at the Discovery Centre, and specialised Summer Courses for Teachers.	(01) 474 8932; dublinzoo.ie
Green-Schools (An Taisce)	Provides support for the Biodiversity Green Flag, including webinars, spotter sheets, and the Habitat Heroes Project.	(01) 400 2222; greenschoolsireland.org
National Biodiversity Data Centre (NBDC)	Platform for citizen science; schools can record wildlife sightings and access biodiversity maps of their locality.	(051) 306 240; biodiversityireland.ie
Biodiversity in Schools	Offers free teaching kits, campaigns like the Big School Bird Count, and an online course: "Helping Nature at School".	biodiversityinschools.com
BirdWatch Ireland	Guidance for the Schools Garden Bird Survey, building nest boxes, and the "Lifelong Learning through Nature" guide.	birdwatchireland.ie
Laois Education Support Centre	Home to a Biodiversity Demonstration Garden ("living classroom") and provider of pollinator lesson plans.	laoisedcentre.ie
All-Ireland Pollinator Plan	Provides evidence-based resources and a Junior Pollinator Plan to help make school grounds bee-friendly.	pollinators.ie
Green Sod Ireland	Delivers ecological education initiatives including "Bee Aware" and the "Animal of the Year" competition.	greensodireland.ie
ECO-UNESCO	Provides the "Nature in the Park" handbook and support for youth-led environmental projects.	ecounesco.ie
Local Biodiversity Officers	Found in most local authorities; they provide advice and information on local biodiversity and heritage issues.	https://www.heritagecouncil.ie/our-work-with-others/biodiversity-officer-programme
ESKER Kits	Environmental Science Kits for Ecological Recording are available for loan in several county library services.	Check local county library services
Spring Alive	An international project for recording migratory bird sightings and facilitating school twinning projects.	springalive.net
BT Young Scientist	A platform for schools to showcase established biodiversity projects and scientific investigations.	btyoungscientist.com
National Parks & Wildlife Service	Resources for Primary School (these include powerpoint presentations that show images of different types of species)	https://www.npws.ie/education/education-resources/resources-primary-schools

Table 8. Biodiversity Engagement and Support for Irish Schools

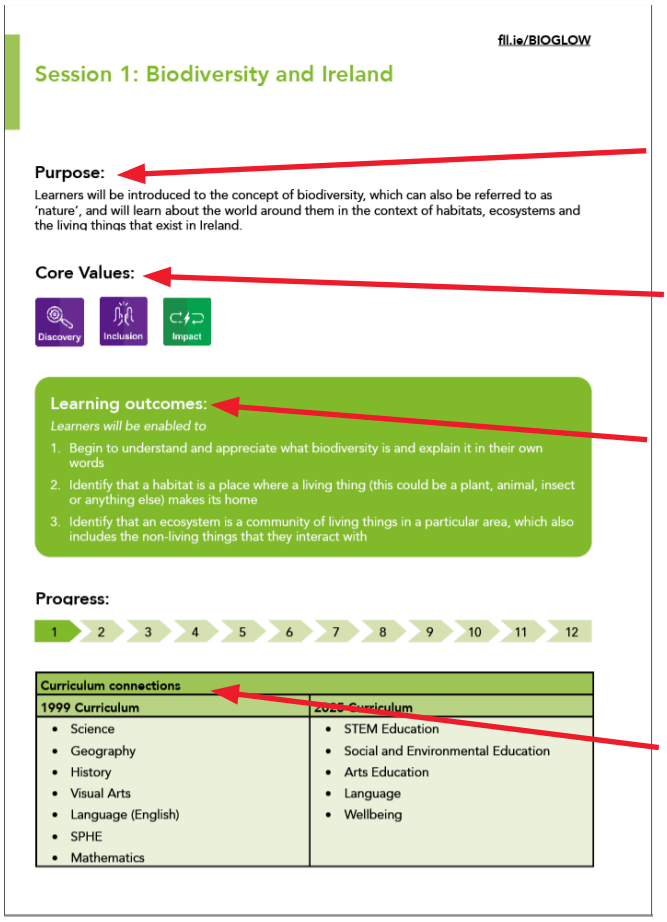
Managing Equipment

Here are are some recommendations on managing the *FIRST* LEGO League Explore BIOGLOW materials:

Before	Ongoing	After
If the sets have been previously used - each team checks that they are not missing any elements before completing their first session. This can be done by comparing the contents against the cover insert. Designate one LEGO Education Set and BIOGLOW Explore Set per team. Where possible, label these to avoid confusion or swapping of sets.	A large lunchbox per team could be used to store the prototyping pieces between sessions. Any LEGO elements found on the floor could be placed in a box on the teacher's desk. Teams missing any elements can then check this box. Move all school bags and personal belongings of learners to the back of the room while completing sessions involving the LEGO materials. This is to avoid any elements accidentally falling into bags or pockets. After building the Explore models, store the printed books containing building instructions for future use.	After the Showcase Event: Each team checks that their LEGO Education Set is not missing any elements. Disassemble the BIOGLOW models and place the pieces (and printed building instructions) into zip lock bags for future use. Prototyping pieces can be resealed into storage containers.



Session Overview



fll.ie/BIOGLOW

Session 1: Biodiversity and Ireland

Purpose:
Learners will be introduced to the concept of biodiversity, which can also be referred to as 'nature', and will learn about the world around them in the context of habitats, ecosystems and the living things that exist in Ireland.

Core Values:

Discovery | Inclusion | Impact

Learning outcomes:
Learners will be enabled to

1. Begin to understand and appreciate what biodiversity is and explain it in their own words
2. Identify that a habitat is a place where a living thing (this could be a plant, animal, insect or anything else) makes its home
3. Identify that an ecosystem is a community of living things in a particular area, which also includes the non-living things that they interact with

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	2023 Curriculum
• Science • Geography • History • Visual Arts • Language (English) • SPHE • Mathematics	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing

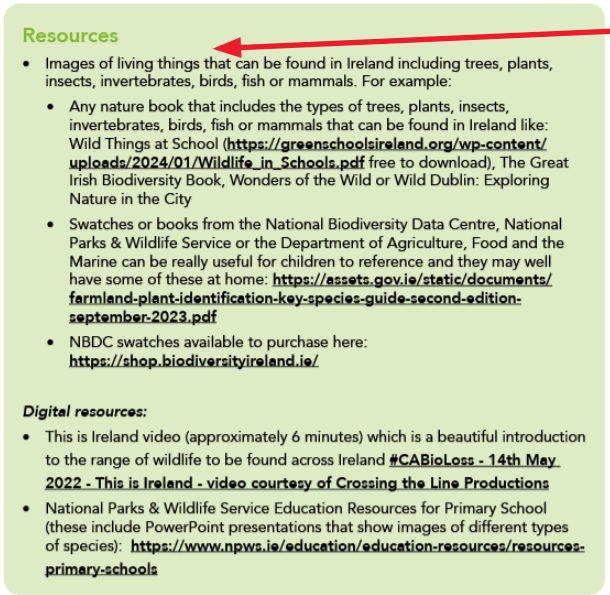
Each session follows the same format.

Purpose: The purpose of each session is provided.

Core Values: Each session will focus on a specific Core Values.

Learning outcomes: Learning outcomes for each session are provided. These are indicative learning outcomes and should be adapted to meet the needs of your learners.

Curriculum content: This includes reference to (i) strand, (ii) strand units/ elements and (iii) skills and concepts.



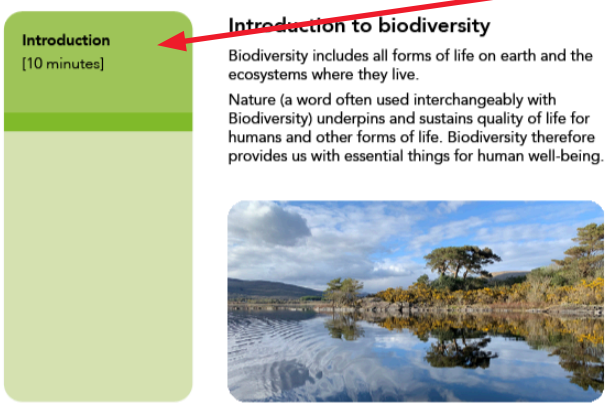
Resources

- Images of living things that can be found in Ireland including trees, plants, insects, invertebrates, birds, fish or mammals. For example:
  - Any nature book that includes the types of trees, plants, insects, invertebrates, birds, fish or mammals that can be found in Ireland like: Wild Things at School (**https://greenschoolsireland.org/wp-content/uploads/2024/01/Wildlife_in_Schools.pdf** free to download), The Great Irish Biodiversity Book, Wonders of the Wild or Wild Dublin: Exploring Nature in the City
  - Swatches or books from the National Biodiversity Data Centre, National Parks & Wildlife Service or the Department of Agriculture, Food and the Marine can be really useful for children to reference and they may well have some of these at home: **https://assets.gov.ie/static/documents/farmland-plant-identification-key-species-guide-second-edition-september-2023.pdf**
  - NBDC swatches available to purchase here: **https://shop.biodiversityireland.ie/**

Digital resources:

- This is Ireland video (approximately 6 minutes) which is a beautiful introduction to the range of wildlife to be found across Ireland **#CABioLoss - 14th May 2022 - This is Ireland - video courtesy of Crossing the Line Productions**
- National Parks & Wildlife Service Education Resources for Primary School (these include PowerPoint presentations that show images of different types of species): **https://www.npws.ie/education/education-resources/resources-primary-schools**

Resources: This includes Team Resources, Digital Resources and any Printable Resources. All digital resources can be accessed via the link provided



Introduction
[10 minutes]

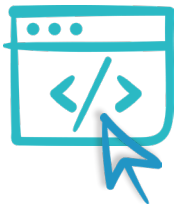
Introduction to biodiversity

Biodiversity includes all forms of life on earth and the ecosystems where they live.

Nature (a word often used interchangeably with Biodiversity) underpins and sustains quality of life for humans and other forms of life. Biodiversity therefore provides us with essential things for human well-being.

Session introduction and development: Learning activities, resources, guiding questions and suggested time frame for each key activity provided. Digital resources are also linked throughout this section and will also be available online at

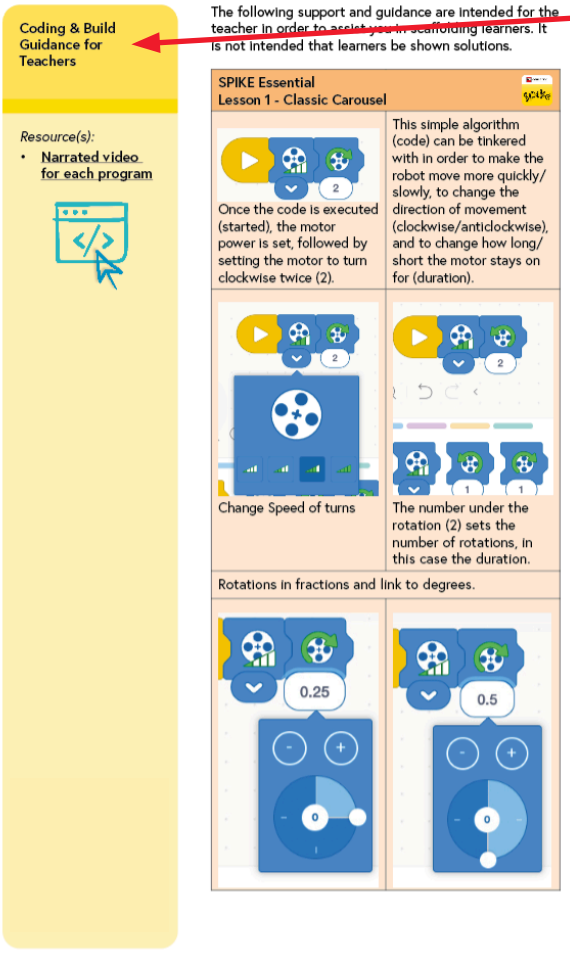
fll.ie/BIOGLOW



Icon to indicate visiting a website

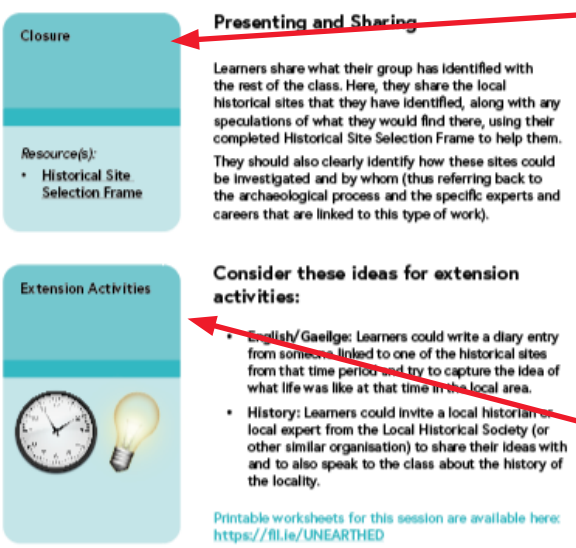
Resource icons:

Resources that require visiting a website or watching a video will have icons under them in the resource section to indicate that a link must be clicked on to access the resource.



Coding and build:

Details of the build and code are provided. Teacher Guiding Questions and Important Points to Note will support the learners' development of computational thinking and coding skills.



Closure:

This is an important feature of every session as it allows learners time to reflect upon their new learnings and understandings. The portfolio or learning diary being kept will be invaluable when learners begin to design their Team Models. Further details and teacher guidance is provided in the next section.

Extension activities:

These highlight activities which develop the learners' skills and knowledge in a specific subject area within the context of *FIRST* LEGO League Explore BIOGLOW. These are optional but recommended extension activities.

Session closures: document, share, reflect

Every session ends with an opportunity for learners to document, share, and tidy up. This is a pivotal part of the Engineering Design Process as it enables learners to reflect and think about what they have learned through the session, in order to build upon this in future sessions.

These session closures have been designed to support learners as they work on their Team Model and Team Poster in the final sessions. By engaging fully with the session closures learners will have completed a lot of reflection in advance of the final sessions, which will make these more effective. For example, the builds and coding explored in earlier sessions should be documented and reflected upon so that learners can iterate and develop upon these for their Team Model.

Below is a general overview of what is intended in these session closures. Session-specific details are provided in the session guides that follow in Part B of this guide.

Document

It is recommended that learners use digital devices and/or portfolio tools to document the **Engineering Design Process** while exploring the sessions in *FIRST* LEGO League Explore.

The process of documenting their progress and ideas can support the learners in **learning to be learners**, and aids in retention of skills and knowledge.

The use of digital devices and digital portfolio tools is also linked to the **Digital Learning Framework** and the Key Competency of **Being a Digital Learner** in the Primary Curriculum Framework.





Share

Teams are invited to share what they did during the session, including demonstrating their model and explaining how their code works. The focus of these sharing sessions is to enable learners to explain their thinking and use the correct vocabulary in their explanations. In the initial sessions the teacher may need to model the types of questions that could be asked. As the class progresses through the sessions, learners from other teams could be called upon to pose questions.

The sharing could be organised in many ways, two recommendations include:

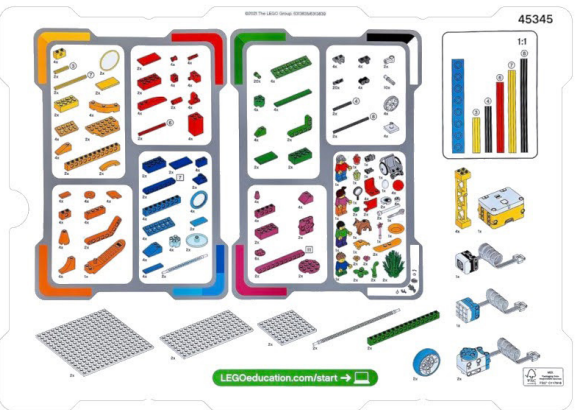
- The team who are sharing bring their LEGO model and digital device to the front of the class - option to connect to the digital display/Interactive Whiteboard.
- The presenting team stays at their work area and all other learners physically move to this work station for the duration of the sharing.

Tidy up

It is recommended that each team be assigned a specific LEGO Education Set for the duration of *FIRST* LEGO League Explore.

It is important to build up an expectation of learners that each team deconstructs and replaces all parts into the correct section of their LEGO Education Set at the end of each session, if appropriate. This will facilitate the following sessions to run smoothly, and avoid the loss of required pieces.

As illustrated in the picture, the LEGO Education Materials SPIKE Essential have specific sections for different categories of pieces, with these pictured on the stickers and on the cover insert.





SPIKE™ Essential Element Overview

Don't forget to share your progress with us where possible through:

Instagram: *@creativehuteducation, @dcu_ioe, @dublincityuniversity*

And use the Hashtag: *#FLLIRE, #BIOGLOW*



Further help and support to schools

Help and support is available to teachers and schools. **Oide** and **Oide Technology in Education** are available

Oide Sustained School Support is a deeper form of teacher professional learning aimed at building internal capacity and enabling schools to drive and embed change as independent communities of learners. The support is provided over a period of time, as part of a deliberately planned process, involving the school and teachers working towards clear and agreed-upon goals. In this context, our advisors will support teachers to collaboratively reflect, identify strengths and needs before deciding on the best way forward for your school.

(PDST, 2021)

Visit **oide.ie** for further information, and to request school support.

Help and support is also available from your local **Education Centre**. This support can include training sessions, cluster groups of schools and teachers, and the loan of equipment and devices. Visit their website for further information, including details of upcoming training events.

LEGO Education Support: For replacement parts, additional kits, workshops and teacher CPD visit **creative-hut.ie**.



BIOGLOW

FOUNDERS EDITION

FIRST LEGO LEAGUE

EXPLORE

Start of Sessions

For the digital version of this guide visit:
fll.ie/BIOGLOW

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Session Overview

Session 1: Biodiversity and Ireland

Learners will be introduced to the concept of biodiversity, which can also be referred to as 'nature', and will learn about the world around them in the context of habitats, ecosystems and the living things that exist in Ireland.

Page: 60

Session 2: Biodiversity Around Us

Learners will prepare to investigate biodiversity in their school or an area around their school, specifically focusing on habitats for pollinators.

Page: 70

Session 3: Biodiversity Around Us - A Focus On Pollinators

Learners will investigate biodiversity in their school or an area around their school, specifically focusing on habitats for pollinators.

Page: 82

Session 4: Rainforests

Learners will be introduced to the Tropical Rainforest ecosystem and build a LEGO model to help think about how life differs at the different layers of the rainforest.

Page: 88

Session 5: How Creatures Adapt to Survive

Learners will be introduced to the work of wildlife biologists and begin to explore how adaptations help living things survive.

Page: 96

Session 6: How Bioacousticians use Sound Sensors

Learners will explore the work of bioacousticians and how they use sound sensors. They will also develop an understanding of how sensors work through building, coding and adapting a LEGO project.

Page: 104

Session 7: The Wildlife Biologist - Tasks and Tools

Learners will explore the work of wildlife biologists and the tools they use to understand how rare species live, interact, and survive. They will also explore how to build and code a LEGO Tree House and adapt it into an imaginary research observation station.

Page: 116

Session 8: Wildlife Conservation

Learners will develop an understanding of wildlife conservation and why preservation and restoration are so important for biodiversity. They will also build and adapt a lifting platform which uses motors, sensors and outputs.

Page: 128

Session 9: Citizen Science - Using Sensors to Protect Biodiversity

Learners will consider how technology (e.g., sensors) can act as our "eyes and ears" to monitor and protect local biodiversity. They will develop an initial awareness of how collecting and analysing environmental data can help us to protect biodiversity.

Page: 142

Session 10: Team Model and Poster

Learners will work in teams to create their Team Model and Poster, which shares what they have learned about biodiversity, and demonstrates an understanding of the work of scientists and the technology used to study and protect nature.

Page: 158

Session 11: Let's share - Preparation for Showcase and Showcase Event

Learners will prepare to share their BIOGLOW project (including the poster and model) at a showcase event.

Page: 170

Session 12: Let's Reflect

Learners will reflect upon their Team Model and Poster, their understanding of biodiversity and ecosystems, and their appreciation for the work of scientists and the real-world technology use to study and protect nature.

Page: 174

Session 1: Biodiversity and Ireland

Purpose:

Learners will be introduced to the concept of biodiversity, which can also be referred to as 'nature', and will learn about the world around them in the context of habitats, ecosystems and the living things that exist in Ireland.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Begin to understand and appreciate what biodiversity is and explain it in their own words
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Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Geography • History • Visual Arts • Language (English) • SPHE • Mathematics	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 30 for full details of Subject, Strands, Strand Units and Skills	

Resources

- Images of living things that can be found in Ireland including trees, plants, insects, invertebrates, birds, fish or mammals. For example:
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Introduction
[10 minutes]



Introduction to biodiversity

Biodiversity includes all forms of life on earth and the ecosystems where they live.

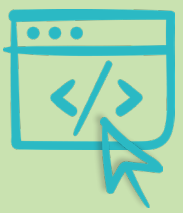
Nature (a word often used interchangeably with Biodiversity) underpins and sustains quality of life for humans and other forms of life. Biodiversity therefore provides us with essential things for human well-being.



Introduction

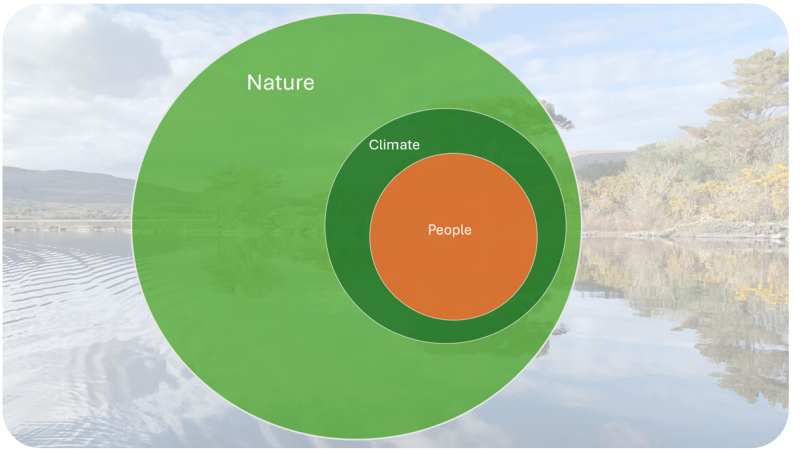
Resource(s):

- Images of nature and humans as a subset of nature
- Images of Landscapes across Ireland to inspire learners to list all of the things that nature provides us with in Resources
- Video link: **This is Ireland**









It is important to remember that humans are only one part of nature. When the environment around us is healthy and biodiverse, that benefits our (human) health and the health of other living things. When we work to protect nature, we are working to help each other.

Use the following video to consider all of the types of wildlife and habitats we have in Ireland (0:00 - 2:55): **This is Ireland**

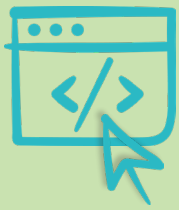
After watching the video, use the following **key questions** to promote small group or whole class discussion:

1. Can you list all of the things nature provides us with?
   (Alternatively or additionally, you can present the learners with images of natural landscapes across Ireland. The learners are encouraged to consider an image or images in pairs or small groups and consider all of the benefits that nature provides us with.)
2. Following this, begin a whole-class discussion with the learners to discuss all of the things that we rely on nature for. These are things like:
   - providing us with air, food, medicine, energy, and fibres.
   - regulating systems including flood protection, water purification, waste decomposition, crop pollination, climate regulation and disease control
   - providing us with benefits in terms of our health, well-being, inspiration, culture and leisure time in nature.

Development
[40 minutes]

Resource(s):

- Video link: **Ireland's Terrestrial Biodiversity**





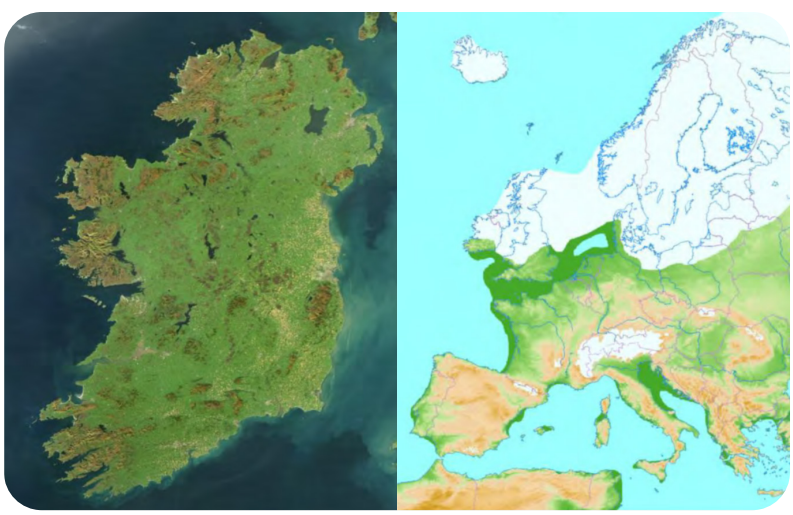


The following short (18min) presentation by Dr Ferdia Marnell (National Parks and Wildlife Service) to the Citizens' Assembly on Biodiversity Loss provides valuable background on these topics for teachers: **Ireland's Terrestrial Biodiversity**

What does biodiversity look like in Ireland?

Historical context of biodiversity in Ireland.

Ireland's biodiversity is a product of our geography, history and climate. Most of our biodiversity developed when ice no longer covered the majority of the land (about 15,000 years ago) and Ireland became an island. Many species that got as far as the UK therefore didn't make it all the way to Ireland, which is why we don't have snakes and moles as two examples! Ireland's biodiversity is therefore unique, no other country has quite the same biodiversity as we do.



Ireland when it was covered in ice and connected to mainland Europe

Some species that can only be found in Ireland are: the Irish hare, the Irish stoat, a shrimp-like crustacean called Niphargus kochianus irlandicus, a type of sea-lavender only found in the Burren, a tree called Irish Whitebeam (which is only found in Kerry) and an Irish marsh orchid.

Development





Irish hare (only found in Ireland)



Irish Whitebeam tree (only found in Ireland)

Activity: Can you list some of the living things that we have in Ireland? (They can be unique to Ireland or also living things that are found elsewhere around the world.)

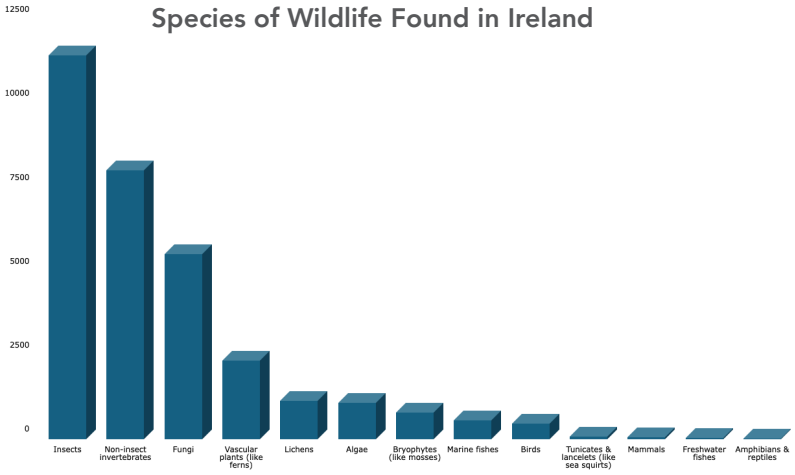
Learners are asked to work in pairs or small groups and think about all of the different types of living things that are in Ireland.

We often only think about mammals when we think of nature, but there is so much more to biodiversity! You might be interested to learn that most of our biodiversity in Ireland relates to our insects and invertebrates (like worms and spiders) and not the mammals, fish or birds!



Development





Following this, the teacher will hold a whole-class discussion with the learners to discuss all of the living things that we can list in Ireland. The teacher may wish to group learners suggestions in the form of a bar chart above, with all of the insects together, all the birds listed together etc. Teachers may also wish to have an additional list for trees that learners might suggest.

What is a habitat and what is an ecosystem?

Scientists such as wildlife biologists, marine biologists, zoologists, ecologists, botanists, entomologists (scientists who specialise in insects), geographers and others work to protect and restore nature. By doing this work, they are also helping us address the problems of Climate Change because the more biodiverse an area is, the better it is protected from the effects of Climate Change.

A *habitat* is a place where a living thing (this could be a plant, animal, insect or anything else) makes its home. When we think about a habitat, it includes everything about that place that contributes to the life of that plant or creature. Examples of habitats in Ireland include hedgerows, forests, freshwater habitats like ponds, lakes and rivers, peatlands, limestone pavements & turloughs, coastal habitats like shingle beaches, sand-dunes & salt-marshes, and more.

For example, the habitat of a sundew plant (a carnivorous plant native to Ireland!) is a bog or peatland where it grows. The habitat of a barn owl might be the edge of a woodland, beside a river where the owls can have somewhere safe to live and be close to a foodsource.



Development





Sundew Plant



A wildlife biologist from Birdwatch Ireland ringing a baby barn owl in its habitat, which was a small woodland close to a river.



Development



Learners work in pairs and imagine themselves as a type of scientist listed above.

Activity: Imagine yourself as one of the scientists listed above and think of an area around your school, your neighbourhood, or a part of Ireland that you'd like to visit. What habitats might you find here? What types of wildlife might you find? Could you draw what you might expect to find?

After this, hold a whole class discussion about the types of habitats learners have considered.

An ecosystem is a community of living things in a particular area, which also includes the non-living things that they interact with. An ecosystem can be the same as a habitat or be a part of a habitat.

For example, a pond can be both a habitat and ecosystem, depending on how we think about it. If we are thinking about the fish living in the pond, we would call the pond its habitat. If we are thinking about all of the other living things in the pond (the plants, the insects, the frogs and everything else) and the non-living things they interact with (like the air and the water), then we can call the pond an ecosystem.



A pond from a Hare's Corner project



Development



For example, in a forest the ecosystem includes all of the living things that are there (from the tallest trees, to the tiniest insects, to the sourest sorrel) and all of the non-living things (like the soil, air and water).

Ecosystems are about the interactions between all the living and nonliving things that are present.

What ecosystems exist around you?

Activity: What types of ecosystems can we think of around our school, homes, villages, towns or cities?

Learners can work in pairs to:

- *Zoom out (like on Google maps) and list all of the living things you can think of that you can easily see in that ecosystem.*
- *Zoom in (as with a magnifying glass) and list all of the living things you can think of that might be harder to spot.*
- *What are the non-living things that also make up that ecosystem?*

After this, hold a whole class discussion on the types and variation in ecosystems that learners have thought about.



Closure

Unfortunately, we have not been looking after biodiversity well in Ireland or around the world. This means that we are less likely to have the precious things that we depend on nature for.

The **good news** is we can do something about this and particularly in the immediate environment around us. Once we know what the quality of biodiversity is around us, we can work to protect it and improve it. Healthy nature means healthy living things, including healthy humans.

Explain to the class that in our next session we will learn more about the quality of the biodiversity in our local area so that we can work to protect it and improve it.

Extension Activities





All digital and printable resources for this session are available here: **fll.ie/bioglow**

Consider these ideas for extension activities:

For further activities and related tasks pertaining to biodiversity in Ireland you can access some of the following resources:

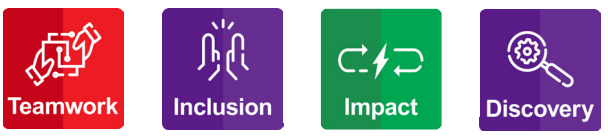
- National Biodiversity Data Centre **https://biodiversityireland.ie/**
- Eanna Ni Lamhna's book on nature in school **https://www.heritageinschools.ie/content/resources/Wild_Things_at_School.pdf?v=1549555361** and worksheets **https://www.heritageinschools.ie/content/resources/Wild_Things_at_School_worksheets_final-minweb.pdf?v=1566225359**
- Trees: **https://greenschoolsireland.org/wp-content/uploads/2024/01/Native-Tree-Species-Cards.pdf**
- **https://theharescorner.ie/about/**
- For coastal habitats: **https://exploreyourshore.ie/resources/**

Session 2: Biodiversity Around Us

Purpose:

Learners will prepare to investigate biodiversity in their school or an area around their school, specifically focusing on habitats for pollinators.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Consider the types of trees that are commonly found around us and classify them as native or non-native
2. Begin to understand and appreciate the work of wildlife biologists
3. Work as scientists to prepare for fieldwork exploring and describing biodiversity, ensuring they collect useful data
4. Utilise their mathematical skills in measure, data and spatial awareness to help them to map and prepare to explore biodiversity in a specific area

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Geography • Mathematics • History • Visual Arts • Language (English) • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 31 for full details of Subject, Strands, Strand Units and Skills	

Resources

- There are several worksheets for Session 2 found at **fll.ie/bioglow**
- Short videos about pollinators: **https://dontmowletitgrow.com/bizzy-flo/**
- Using quadrats outdoors: **https://www.saps.org.uk/teaching-resources/resources/258/ecology-practical-1-measuring-abundance-and-random-sampling/**
- National Biodiversity Data Centre - All Ireland Pollinator Plan for Schools **https://pollinators.ie/schools/**

Supplementary resources:

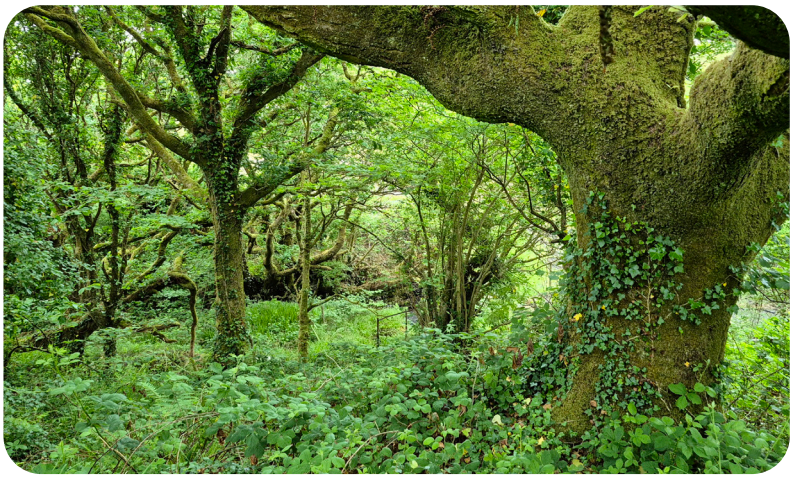
- National Parks & Wildlife Service Education Resources for Primary School **https://www.npws.ie/education/education-resources/resources-primary-schools**
- Tree Council of Ireland (images and details of trees to be found in Ireland): **https://www.treecouncil.ie/native-irish-trees?srsltid=AfmBOoqrw83SzIDi7oFy4nOABvXYc46zCSHnROi0_nf7skrtN4btnqoL**
- Images of native trees found in Ireland: **https://www.ucc.ie/en/tree-explorers/trees/a-z/**
- Presentation about pollinators which could be adapted for use when introducing pollinators: **https://pollinators.ie/wordpress/wp-content/uploads/2018/05/Junior-Pollinator-Plan-presentation.pdf**
- **https://www.heritageinschools.ie/content/files/Biodiversity-Plan-for-Schools-Geoff-Hunt.pdf**
- **https://greenschoolsireland.org/wp-content/uploads/2024/01/FB-COMBINED-FILE-Habitat-Mapping.pdf**



Introduction
[10 minutes]



Biodiversity around us



Irish forest (Coillte)

Trees in Ireland

The image of an Irish forest can be used as a stimulus to encourage the class to consider why we need trees.

After seeking answers from the class, explain that trees are hugely important when we think of biodiversity. Not only do we rely on them to produce oxygen and give us shade when it is very warm, they also protect us from flooding and provide habitats to hundreds of different types of other living things.

Forests are large, complex ecosystems that are mostly made up of trees and other woody vegetation. An area of about the size of a football pitch, that has tree canopy cover (i.e. a green roof made by the trees) of more than 10% can be considered a forest. They are vital habitats that support vast biodiversity and regulate the global climate.

Once upon a time, the majority of the island of Ireland was covered in forests but now approximately 10% of our land has forests. Only 2% of land has forests of native woodlands and these types of forests are incredibly precious.

Explain to learners that we only have very small areas of very ancient woodland left in Ireland. They can be found in small pockets around the country. They are incredibly precious because they would be so difficult to replace if they got burned or knocked down. As part of the EU Nature Restoration Law, Ireland must try to protect and restore these ancient woodlands.



Introduction

Resource(s):

- Worksheet per pair/small group: **Native or Non Native Tree**



A native woodland in Co. Cork

Remind the class that in our last session we learned that long ago Ireland was mostly covered in snow and ice. As this melted trees began to grow. The seeds of trees such as hazel and oak were brought here by birds and animals across the land bridges that existed then between Ireland, Britain and mainland Europe. The seeds of other trees, such as willow and birch, were blown here by the wind. We classify native trees as those that were here before we were separated from the rest of Europe and became an island.



Activity: Can you guess which of the following trees are native to Ireland and which aren't?

Learners work in groups or pairs to first of all see if they can name the type of tree each leaf is from and then decide if it is a native or non-native tree.

Printable resource per pair/group: **Native or Non Native Tree**

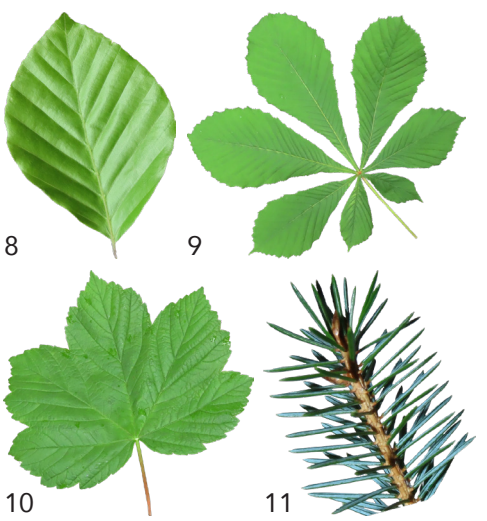


1. Hawthorn
2. Hazel
3. Holly
4. Alder
5. Ash
6. Irish Oak
7. Scots Pine
8. Beech
9. Horse chestnut
10. Sycamore
11. Sitka spruce

Native



Non native



After completing this identification activity, explain to the class that trees are vital for our biodiversity. Trees are also an important food source for pollinators. In Spring, when there are not a lot of flowers out to feed these insects, trees like Willow and Rowan are especially important.



Introduction





Willow Tree (Irish Examiner)



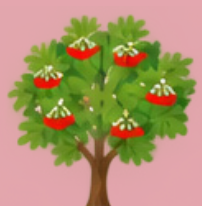
Rowan Tree (All Ireland Pollinator Plan)

Development
[10 minutes]

Being Wildlife Scientists: A Focus on Pollinators

A pollinator is anything that helps move pollen from one part of a flower to another.

This movement fertilises a plant, helping make seeds, fruits, and new plants. 'Pollinators' can therefore refer to butterflies, moths, flies, bees, birds and bats. In Ireland, we don't have any birds that are pollinators but we have everything else and we rely on them all!



Development



Quiz:

Which of the following foods is not pollinated by insects?



Answer: None - all are pollinated by insects!

Depending on your class you might wish to discuss with them that while most staple grains (like wheat, corn, and rice) are wind-pollinated or self-pollinated, pollinators are critical for dietary diversity and micronutrients. Nearly 75% of global crops and over 80% of wild flowering plants depend on animal pollinators like bees, butterflies, birds, and bats. Without them, we would lose key crops like apples, almonds, berries, and coffee and other living things would also struggle to survive without their habitats and food sources. Healthy ecosystems depend on pollinators.

What insects are the main pollinators of plants in Ireland?

Answer: Bees!





Development



Fun fact: Did you know that Ireland has 99 different species of bees? Honeybees are only one of these species (and unfortunately some honeybees are imported to Ireland and put our other bee species at risk). The majority of our bees are Solitary Bees who live alone and need places, like mounds of soil, walls or bee hotels, where they can make a home.



While pollinators are hugely important for our human food systems and the food systems of other living things, their populations are declining.

On the island of Ireland, **one third of our wild bees** (bumblebees and solitary bees) are threatened with extinction. This is mainly because we've drastically reduced the habitats that provide them with food and shelter. Other factors include pesticides, pests and diseases, and climate change.

To help these important insects, we need to ensure pollinators have food, shelter, and safety from chemicals.

We want to see how well our school (or local area) is acting as a habitat for these important pollinators.

In our next session we're going to go outside and take a look at the trees and plants that are around our school (or local area) and consider how well the area is acting as a habitat for pollinators.

Preparing for our fieldwork as scientists
[30 minutes approx]
Explain to the class that we are going to begin our work as scientists. Like all scientists, we first have to carefully plan our fieldwork (before we go outdoors) to make sure that we have all of the correct equipment and resources ready, so that the information we collect is useful.

Divide the class into pairs or small groups in preparation for our fieldwork.



Development



Note to teacher:

- This fieldwork could take place in the school grounds/yard, or in an area around the school (e.g., local park/forest).
- Depending on the size of the area being surveyed, the map could be divided up and allocated to different pairs/groups.
- pairs/groups could be tasked with a specific focus, e.g., trees/insects, or could survey everything in the allocated area.
- Multiple editable sample data collection sheets are linked. These can be used to help explain and organise the biodiversity survey.

1. Sketch a map:



All Ireland Pollinator Plan

Before we go outside, we need to sketch a map of the area we are going to investigate. Begin by sketching a rough map of the area on the teacher's whiteboard. Explain to learners that this map needs to be large enough that we can add further detail to it when we begin our survey.

Instruct pairs/groups to sketch their maps. If pairs/groups are being assigned specific areas they can be asked to create a more detailed sketch of the area assigned to them.



Development

Resource(s):

- Worksheets for Session 2: **fll.ie/bioglow**

2. Deciding what biodiversity data to collect in our area

As wildlife scientists, we are going to record the biodiversity in our area and will focus on habitats and food sources for pollinators.

Ask learners to consider:

- *What type of information are you going to collect outside and how might you record this in a useful way?*
- *What sheets might you bring with you?*
- *Will you need anything with you to help you identify trees or plants etc.?*

Pairs/teams could focus on recording different aspects of our local biodiversity. For example, they could:

- Survey the types of trees
- Survey the types of flowering plants
- List and map the visible habitats
- Use a quadrat to detail what they find in different sections of the area they are investigating
- Calculate the (approximate) area of grass that is mowed / section that has wildflowers / section that has a pocket forest etc.

3. Deciding how to collect biodiversity data

There are many approaches which could be taken to completing this biodiversity survey. Below are some suggestions:

a. You may wish to simply record all the animals *(including insects and invertebrates {like worms})* that you see, writing detailed notes on where you saw them and what they were doing.
   i. See an example of what this could look like: **Session 2_Animals spotted during our fieldwork**

b. Alternatively, you might want to bring out quadrats (square shapes) to drop on the ground and note what you see in that space.
   i. See an example of what this could look like: **Session2_Recording our Quadrat Data during Fieldwork** This could be adapted easily to your local area.



Development





ii. The following resource provides a very good explanation of how to use quadrats for this type of survey: **https://www.saps.org.uk/teaching-resources/resources/258/ecology-practical-1-measuring-abundance-and-random-sampling/**

c. If you are going to detail the trees growing you might like to prepare a tally sheet.

   i. See an example of what this could look like: **Session2_What trees are growing**
   This could be easily adapted to your local area

d. If you are going to detail the **flowering plants** growing you might like to prepare a table to detail where they are growing and if they are pollinator friendly plants or not.

   i. See an example of what this could look like: **Session2_Survey of Flowering Plants**

   ii. You may not be able to identify all of the plants you see, so be sure you have space to describe them so you can label them later or come back to the area later to identify them. The Top 10 Pollinator Plants resource listed below might be a helpful resource or this poster of native wildflowers: **https://pollinators.ie/wp-content/uploads/2025/04/AIPP-Wildflower-Seeds-A5-flyer-WEB.pdf**

e. You might like to **survey mini-habitats** you find like: patches of bare earth, drystone walls, or little wild areas that bees can live in, with food sources like dandelions close by.

   i. See an example of what this could look like: **Session2_ Surveying the area for Current Habitats for Pollinators**
   This could easily be adapted to your local area

f. If you are **calculating the approximate area(s)** of the land you are surveying, what type of instruments will you need? How will you record your measurement?

   i. See an example of what this could look like: **Session2_Calculating the Approximate Area of our Space**

Closure

Instruct the class to imagine they are about to explain their planned biodiversity survey to an interviewer. If they only had 30 seconds, what would they say?

Encourage learners to include what biodiversity data they hope to collect, how they hope to collect it, and why this data will be helpful.

To conclude this session, explain to the class that we have worked as wildlife scientists to prepare for our biodiversity survey in the next session. By doing this well, we know we will have some great data to make conclusions about biodiversity in our chosen area. It will also allow us to make a plan as to how we might improve this area for pollinators in the future!

Extension Activities



All digital and printable resources for this session are available here: **fll.ie/bioglow**

Consider these ideas for extension activities:

The following 'top ten' lists prepared by the **National Biodiversity Data Centre (NBDC)** could be used as the basis for further discussion by learners:

- Top 10 Pollinator Plants
  https://pollinators.ie/wp-content/uploads/2023/04/Top-Ten-pollinator-plants-Guide-WEB.pdf
- 10 Species at Risk of Losing
  Over 31,000 species have been documented for Ireland. Species diversity in Ireland is maintained because of the variety of habitats and environmental conditions available for plants and animals to live and reproduce. Here is a selection of just 10 of Ireland's most threatened species.
  https://biodiversityireland.ie/top10/10-species-at-risk-of-losing/
- 10 Most Unwanted Species
  Invasive non-native plant and animal species are the second greatest threat to biodiversity worldwide after habitat destruction. Ireland is no exception, and many species that are newly arrived to Ireland have disrupted local ecosystems and threaten our native biodiversity.
  https://biodiversityireland.ie/top10/10-most-unwanted-species/
- Summary of the EU Nature Restoration Law and how Ireland might fulfill its obligations to 2050 can be found here:
  https://www.restorenature.ie



Session 3: Biodiversity Around Us - A Focus On Pollinators

Purpose:

Learners will investigate biodiversity in their school or an area around their school, specifically focusing on habitats for pollinators.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Explore, map and describe biodiversity in their school grounds or in an area around their school.
2. Identify habitats for pollinators in or around their school.
3. Propose ideas to further support pollinators by improving their habitats in areas in or around their school.

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Mathematics • Geography • History • Language (English) • Visual Arts • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 32 for full details of Subject, Strands, Strand Units and Skills	

Resources

- Maps prepared in last session
- Survey tools/sheets prepared in last session
- Sample survey tools from Session 2:
  - Session 2_ Surveying the area for Current Habitats for Pollinators
  - Session 2_Animals spotted during our fieldwork
  - Session 2_Calculating the Approximate Area of our Space
  - Session 2_Recording our Quadrat Data during Fieldwork
  - Session 2_Survey of Flowering Plants
  - Session 2_What trees are growing
- Quadrats (if being used)
- Digital devices to take photos of wildlife to aid in identification
- Paper, pencils, colours

Introduction
[5 minutes]

Remind the class that in our last session we began to work as wildlife scientists by preparing for our biodiversity survey. In this session we have three goals:

1. Complete a biodiversity survey of our school or local area
2. Review our collected data and plan how best to communicate our data to others.
3. Make a plan as to how we might improve this area for pollinators in the future

Instruct the class to break into their pairs/groups and prepare their maps and data collection tools/sheets.

Remind learners of any rules to follow while working outside of their classroom.



Development

Resource(s):

- Sheets that learners have prepared in Session 2
- Digital devices
- Paper, pencils, colours



1. Walk the school grounds [20-30 minutes]

In pairs or teams of scientists, learners walk around the school or the chosen area and record biodiversity data, using the tally sheets, surveys or field sheets they have prepared.

Remind learners that if they don't know the name of the plant or tree, note where it is and see if they can come back with someone who might know or with a book or a swatch that might help identify the tree or plant.

Learners could also use a digital device to take a photo of any wildlife they cannot identify so that it can be discussed later in class.

If time allows, have pairs/teams sit silently for three minutes and use digital devices to record the sounds of the habitat, similar to how bioacousticians use sensors.

Note to teacher:
the time required for this activity will vary by class level, size and variety of biodiversity available.

2. Reviewing our data [20 minutes]

In their teams, learners review their data and consider how they will communicate it to the rest of the class.

The following **key questions** could help scaffold learners:

I wonder…

- *Is it enough to say all the types of life we found, or is it important to explain how 'abundant' or 'scarce' they are? What could that tell us about this type of wildlife? (i.e., which habitats are performing best for pollinators)*
- *How would a pollinator (e.g., butterflies, moths, flies, bees, birds and bats) view the map your team created? What parts would they see as treasures (e.g., food sources, nesting sites) and which as troubles to avoid (e.g., mown grass, pesticides, lots of human activity). Why do you think so?*
- *What patterns do you notice? What was similar or different between the areas where there was an abundance (lots) of wildlife, and a scarcity?*

Development

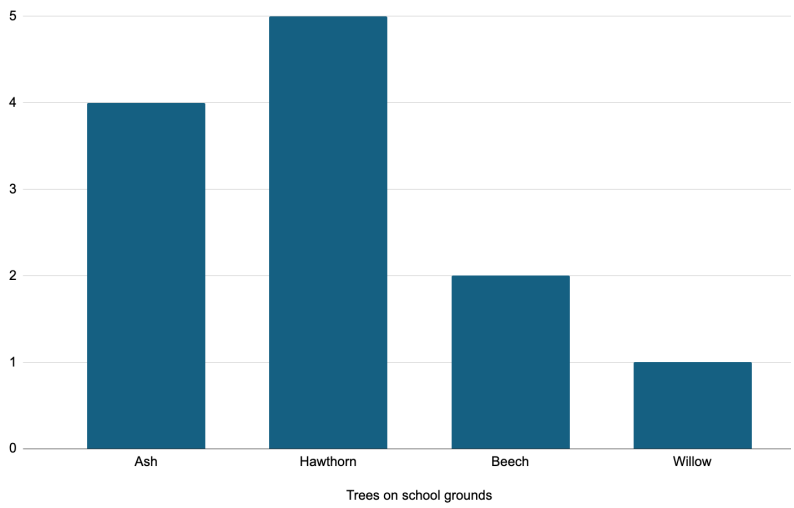


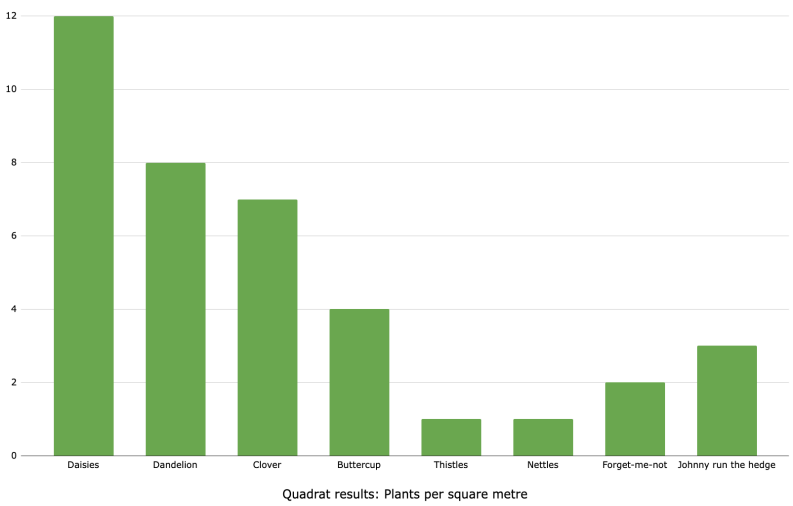
- *What was the most common type of plant you noticed in your survey? Why do you think this is the most common? Do you think this is good for pollinators?*
- *Do you think the plants you found were naturally grown or planted by people? What evidence did you find?*
- *If we did this survey again during a different time of the year, would anything change? What do you predict would be different? Why do you think so?*
- *How about if the weather were different?*

The teacher will facilitate this work and, afterwards, provide learners with an opportunity to communicate their findings to the rest of the class.

Now that we have concluded our fieldwork, we have to be able to communicate our data to others. Ask the class to consider how they might display their data and calculations?

The images below could help scaffold learners:







Closure

Resource(s):

- Paper, pencils, colours



Make a plan as to how we might improve this area for pollinators in the future [10-15 minutes]

Explain to the class that while working as wildlife scientists, the important data they have collected could help create change on our school grounds or in our local area to benefit the pollinators and, hence, biodiversity.

Using all of the data we have gathered and displayed as a class, what might we propose to improve this area for pollinators? Our work will contribute to the national and European Nature Restoration Law, because we must all ensure that pollinator populations stop declining and start increasing.

Instruct the pairs/teams to create a new map of the area they surveyed and mark the pollinator friendly areas and areas that could be improved.

While the class work, the following **key questions** could help scaffold learners:

1. *Could we mow the grass/pitches less often (or less short) to allow for more pollinator friendly plants like dandelions and clover to grow?*
2. *Could corners of the lawn be left unmown so that more wild grasses and flowers grow?*
3. *Could any areas be planted with pollinator-friendly plants (preferably native plants that would support our native bee population)?*
4. *Are there areas that might be developed as places for solitary bees to live like patches of dry land, walls with gaps or could we make a bee hotel?*
5. *Are there any areas where herbicides or pesticides are being used that could do without these chemicals?*
6. *Are there any cartoons or signs we could design or print and show to demonstrate the important work we are doing to protect the pollinators?*

You may wish to bring this work to your student council/Green Schools Council or your principal to suggest changes that you might make as a school.

If you did it in a local area close by, the class could share their data and map with the local authority or a local councillor, making sure they understand how important pollinators are and demonstrating how we can all make a positive impact to the lives of pollinators by being mindful of what we grow, mow and show.

Extension Activities







Printable worksheets for this session are available here: **fll.ie/bioglow**

Consider these ideas for extension activities:

The "Digital Field Diary" (Sharing Findings)

Your class could use digital tools to communicate their findings to the school community, acting as official scientific communicators.

- **Multimodal Portfolios:** Teams use **Book Creator** or **Canva** to create a "Local Habitat Guide." They can import photos taken during the walk, add digital labels to identify native plants, and insert audio recordings of their "Sound Walk".
- **Scientific Podcasting:** Groups record a 2-minute podcast episode using **Vocaroo** titled *"The Pollinator Report."* They must describe one "Treasure" they found, one "Trouble" they identified, and their top three data-backed suggestions for the Principal.
- **Class Polling:** Use a digital response tool like **Mentimeter** to create a class word cloud of the most common species found, helping learners visualise the **abundance** of local biodiversity in real time.



Session 4: Rainforests

Purpose:

Learners will be introduced to the Tropical Rainforest ecosystem and build a LEGO model to help think about how life differs at the different layers of the rainforest.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Begin to understand and appreciate the importance of rainforests
2. Identify and discuss different types of life present in a rainforest ecosystem
3. Begin to appreciate how and why life differs across different rainforest layers

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Geography • Science • Visual Arts • Language (English) • SPHE	• Social and Environmental Education • STEM Education • Arts Education • Language • Wellbeing
See p. 33 for full details of Subject, Strands, Strand Units and Skills	

Resources

- Book 1 and Bags 1 - 3 from the Explore Set
- BIOGLOW Mat from the Explore Set
- Mini-whiteboards or paper and markers

Digital resources:

- Images for Discussion - **Session 4_Rainforests_Images** - One per group
- **Biologists! Scientists Who Love Life!** (0:00 - 2:00)
- **Animal Mimicry + Camouflage | Life in Color with David Attenborough** (0:00 - 1:19)
- **Rainforests 101 | National Geographic** (0:00 - 3:40)



Introduction
[10 minutes]



Introduction to Tropical Rainforests

Having focused on ecosystems and habitats in Ireland in the previous lessons, explain to the class that we are now going to explore a very different ecosystem.

Distribute the images for discussion grid to each group, and instruct learners to use clues to figure out what type of ecosystem this is.

After groups have had a chance to examine the pictures, use the following **key questions** to promote a whole class discussion:

- *What types of living things do you notice?*
- *What kinds of plants grow there?*
- *Where do you think this is? Why do you think so?*
- *How do the creatures and plants interact with each other?*
- *How is this ecosystem similar and/or different from the Irish ecosystems we have examined?*
- *Would you find similar/different creatures in both? Why/why not?*

Introduction













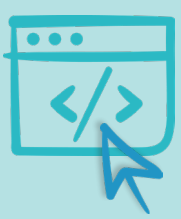


The full sized labeled images can then be displayed on the interactive whiteboard to help explain that these are images of different tropical rainforests in Hawaii, The Amazon Basin, and Costa Rica.

Development
[40 minutes]

Resource(s):

- **Rainforests 101 | National Geographic**



What are Rainforests?

[5 minutes approx]

Use the following video from National Geographic to learn more about tropical rainforests

Rainforests 101 | National Geographic (0:00 - 3:40)

After watching the video, the following **key questions** could be used to promote a whole class discussion:

- *Why are they called rainforests?*
- *Why are rainforests important? (they are home to approximately half of all of the plant and animal species in the world and are hence vital for biodiversity; source of ingredients for medicines; . they store carbon and provide us with oxygen)*
- *What are the differences between a tropical rainforest and a temperate rainforest? Where would you find a temperate rainforest?*

Development

Resource(s):

- Book 1 and Bags 1 - 3 from the Explore Set



Build Rainforest Tree Model & Discuss
[30 minutes approx]

Divide the class into small groups (4 learners) and explain that each group is going to build a model which represents a tree found in a tropical rainforest.

Each team will need Book 1 and Bags 1 - 3 from the Explore Set. Instruct each team to build their tree models.



While groups are building their tree models, encourage them to think about and discuss:

- *What living creatures might live on/in/under/over this habitat?*
- *Would any of the living things from the earlier photos be found in this habitat? Where/which part of the tree?*
- *Why do some living creatures live on the forest floor, and others live high in the canopy (upper branches)?*
- *How would life be different at these different levels?*
- *How might this be similar or different to forests in Ireland (temperate rainforests)?*

Depending on the class, you may like to introduce the layers of the Rainforest midway through building the tree model, or after it has been finished.

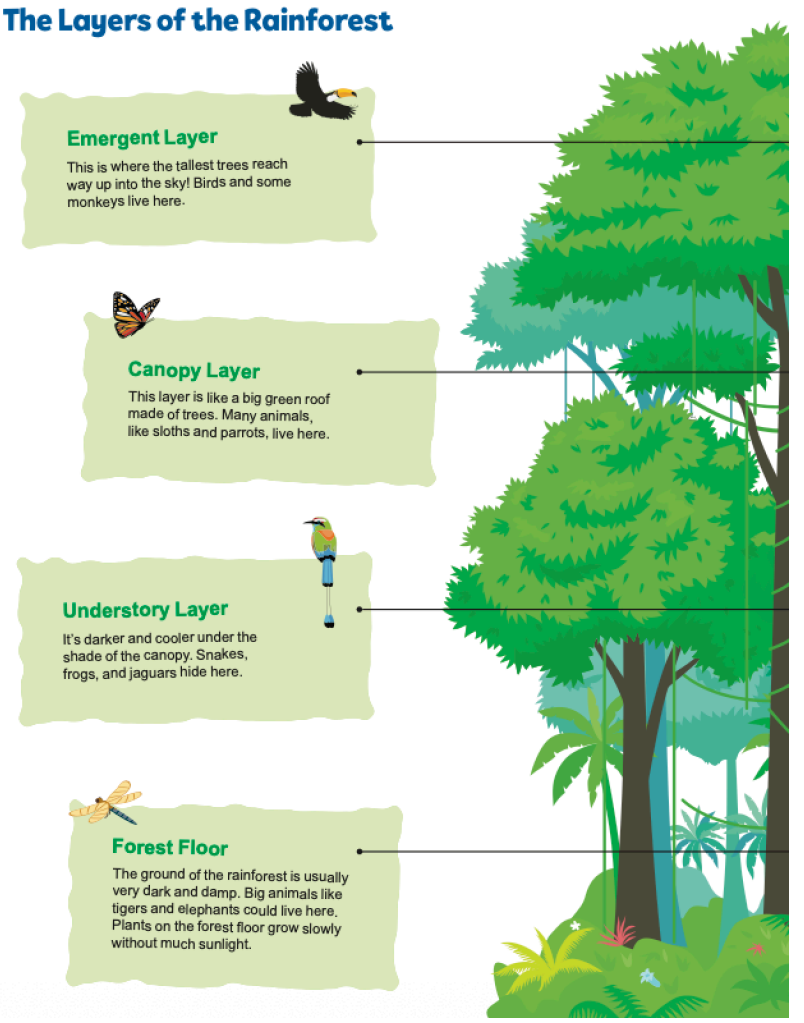
Development





The Layers of the Rainforest
[5 minutes approx]

Explain to the class that the competition for sunlight in the rainforest creates four distinct layers, each supporting a unique community of life. Use the discussion image below, and in the Images for Discussion resource to help explain the four layers:





Development



1. Start by explaining the **Emergent Layer**, where the tallest trees reach way up into the sky, providing homes for birds and agile monkeys who can withstand the intense heat and wind.
2. Below this is the **Canopy Layer**, described as a vast "big green roof" that captures most of the sunlight and provides a lush environment for sloths and parrots.
    a. In an Irish context, this is primarily formed by Oak, Ash, and Birch
3. Transition to the **Understory Layer**, noting that it is significantly darker and cooler because it sits in the shade of the canopy; here, learners can imagine snakes, frogs, and jaguars hiding among the shorter plants.
    a. In an Irish context, specific native species like Holly, Hazel, and Hawthorn tend to adapt in oak woodlands because their dark green leaves tolerate low light
4. Finally, introduce the **Forest Floor**, which is typically dark and damp, where plants must adapt to grow very slowly without much sunlight, and large animals like tigers and elephants roam.
    a. The Irish Ground Layer features leaf litter, rotting logs, mosses, and ferns

To deepen their understanding, have the class use their **"STEM eyes"** to compare this structure to a local Irish woodland, which similarly depends on how much light reaches the ground to determine which plants can survive in the shrub, herb, and ground layers.

Note:
Like we explored in Sessions 2 and 3, it will be important to compare a local woodland or forest that has mostly native trees. Non-native forests, such as those of Sitka Spruce are grown to produce timber - their tight canopies block sunlight to the forest floor, fallen needles from the trees acidify the soil, and their lack of varied native flora deprives local wildlife of necessary food and shelter.



Sharing & Discussion
[10 minutes]



Mini-Whiteboard Layer Showdown [5 minutes]

Instruct each group to grab mini-whiteboards (or paper) and markers. Explain that you will call out an animal or environmental clue, and the teams must secretly consult, write down the correct rainforest layer, and hold it up on the count of three.

Clue Prompts to Use:

- *Clue 1: "This layer acts like a 'big green roof' where sloths and parrots love to hang out." (Answer: Canopy Layer)*
- *Clue 2: "It is very dark and damp down here, and large animals like elephants roam around." (Answer: Forest Floor)*
- *Clue 3: "This is where the tallest trees poke all the way up into the sky to meet the wind." (Answer: Emergent Layer)*
- *Clue 4: "It's darker and cooler here because it's shaded by the canopy. Keep an eye out for jaguars hiding!" (Answer: Understory Layer)*
- *Clue 5: "Think back to our introductory photos. Where would our bright orange poison dart frog friend most likely be hunting for bugs?" (Answer: Forest Floor / Understory)*

Build our class Rainforest [3 minutes]

Have each small group bring their completed LEGO tree models over to the BIOGLOW Mat to create a collective "tropical rainforest canopy" in the room.

Ask teams to share how one specific layer of the rainforest is represented in the model (e.g., the dense canopy or the roots on the forest floor).

Wrap-Up [2 minutes]

Bring the class back together for a final wrap-up question to consolidate their learning:

Ask the class to consider the following question: *"if a monkey from the Emergent layer of the Amazon visited a local Irish woodland, what would surprise them most about the layers of an Irish forest?"*

Conclude by reminding them that while Irish woodlands have fewer, and shorter layers due to a milder climate, both ecosystems completely rely on how sunlight filters down to determine who survives where.



Extension Activities







Printable worksheets for this session are available here: **fll.ie/bioglow**

Consider these ideas for extension activities:

Comparing Irish Forests and Tropical Rainforests:

- Create a side-by-side vertical diagram comparing a tropical rainforest to a local Irish woodland on poster paper.
- Label and draw the four tropical layers on one side and the local Irish woodland layers (shrub, herb, ground layers) on the other.
- Encourage learners to use "STEM eyes" to draw lines connecting ecological equivalents, demonstrating how both ecosystems adapt to light competition.

"Save Our Layer" Persuasive Debate/Writing

- Revisit the land-clearing/deforestation imagery examined during the lesson introduction. Appoint each small group as the official "Eco-Guardians" of one specific rainforest layer.
- Teams use their mini-whiteboards to list why their layer is critical to global biodiversity. Groups may refer to the National Geographic video, or seek further information from reliable sources to help them in arguing for their layer.
- Have a team spokesperson deliver a rapid 1-minute persuasive speech to the class arguing why their layer must be protected



Session 5: How Creatures Adapt to Survive

Purpose:

Learners will be introduced to the work of wildlife biologists and begin to explore how adaptations help living things survive.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Develop their understanding and appreciation of the work of wildlife biologists
2. Understand how adaptations help living things survive
3. Categorise, classify and explain animals' adaptations

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Geography • Visual Arts • Language (English) • SPHE • Mathematics	• STEM Education • Social and Environmental Education (SEE) • Arts Education • Language - English • Wellbeing
See p. 34 for full details of Subject, Strands, Strand Units and Skills	

Resources

- Book 2 and Bags 4 - 6 from the Explore Set
- BIOGLOW Mat from the Explore Set
- Mini-whiteboards or paper and markers

Digital resources:

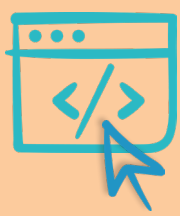
- **Biologists! Scientists Who Love Life!** (0:00 - 2:00)
- **Animal Mimicry + Camouflage | Life in Color with David Attenborough** (0:00 - 1:19)



Introduction
[10 minutes]

Resource(s):

- **Biologists! Scientists Who Love Life!**



Use the first two minutes of this video to introduce biologists as scientists who study life: **Biologists! Scientists Who Love Life!** (0:00 - 2:00).

After watching the video, use the following **key questions** to promote small group or whole class discussion:

- *What is a biologist?*
- *What types of life do biologists study? (e.g., plants, animals, fungi, microscopic organisms)*
- *Where do they work?*
- *What kinds of things might a biologist study?*

Introduction



A biologist is a scientist who studies the living world to understand how plants, mammals, insects, fish, fungi and other organisms survive and thrive. Explain to learners that they are like nature detectives who ask "I wonder..." questions to figure out what living things need to stay healthy. They sometimes use tools like cameras and trackers to safely watch animals in their habitats.

Their job is very important because it helps us learn how to take care of the environment and protect all the different species on our planet. When scientists like wildlife biologists look after nature, this benefits biodiversity and protects us from the effects of Climate Change.

Remind the class that there are many types of biologists, and they study different living things to learn more about them. Three specialist types of biologists include, Entomologist (insect expert), Ornithologist (bird expert), and Botanist (plant expert).

Development

Resource(s):

- Book 2 and Bags 4 - 6

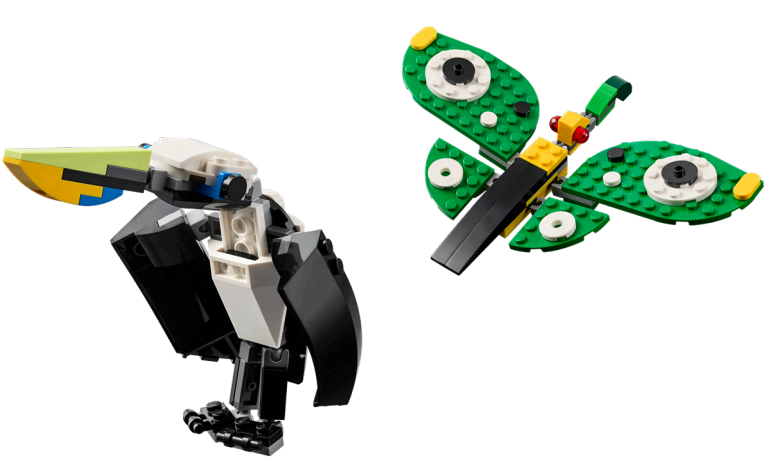


Explain to the class that we are going to work as teams of wildlife biologists to study three different living things.

Build animal models [20min approx]

Divide the class into teams. Each team will need Book 2 and Bags 4 - 6 from the Explore Set. Instruct each team to build their animal models. There are three models and each will take approximately 8 minutes to build.





Development



Examine and categorise animal models
[10min approx]

Instruct each team to work as wildlife biologists to discuss and describe their three models. The following **key questions** could help scaffold learners: I wonder…

- *What type of animal is this?*
- *How does it move? How can you tell?*
- *What does it eat? Why do you think so?*
- *How does it see/hear?*
- *What colours is it? Does it have any patterns? What might this tell us about the animal?*
- *Where does it live? Why do you think this?*

After sharing their observations and justifications, explain to the class that when biologists study living things they use clues like their body parts as evidence to learn more about how they live.

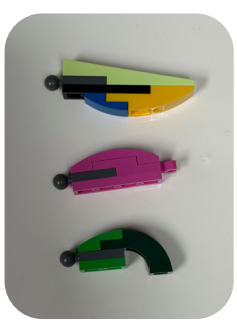
Ask the learners to work in their groups to organise the different body parts into categories.

Note to teachers:
Each model has ball and socket joints to connect the different body parts. This allows the parts to be connected and disconnected easily.

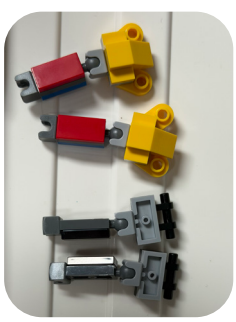
Learners could use whiteboards or paper and markers to classify and label their animal body parts. Some potential classifications include:



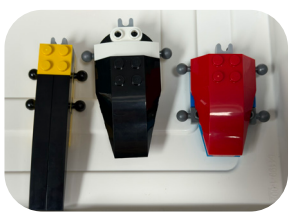
Wings



Mouthparts & beaks



Legs



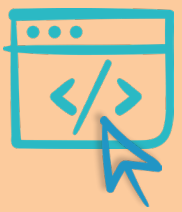
Body

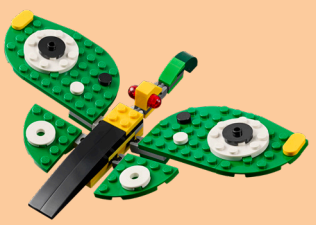


Development

Resource(s):

- **Animal Mimicry + Camouflage | Life in Color with David Attenborough**





Once teams have classified the body parts into categories, encourage them to think about why an animal developed or adapted these body parts? I wonder:

What was it about where they live that requires them to need these types of body parts?

What does their mouthpart or beak suggest about what they eat?

Taking the green butterfly as an example, ask learners to think about its colour and wing patterns. This is an example of animal adaptation called camouflage. Many animals use specific shapes, colours, or patterns to blend in with their surroundings to hide from predators or sneak up on prey.

Play the short video (1:19) **Animal Mimicry + Camouflage | Life in Color with David Attenborough** to allow the class to experience a range of animal adaptations as explained by a wildlife biologist.

Some of the following examples of adaptations could be shared with learners:

- Sensory Adaptation:
  - *Echolocation:* Mention that while all nine types of Irish bats can see, they use sound to "see" in the dark.
- Behavioural Adaptations:
  - *Migration:* Use the example of the Painted Lady butterfly, which migrates from North Africa to Ireland, or the Swallow, which travels to South Africa
  - *Hibernation:* Animals like hedgehogs and frogs hibernate to conserve energy during cold winters when food is scarce
  - *Nocturnal:* Badgers have adapted to be nocturnal and live in setts during the day to stay safe. Honeysuckle attracts moths at night by releasing a special scent at night time.

Create a creature [10min approx]

Ask the learners to imagine they are wildlife biologists who have found a new type of living thing never seen before (see labelled example below).

I wonder:

- *Which rainforest layer does it live in?*
- *What does it look like?*
- *How has it adapted to survive in that layer?*

Development



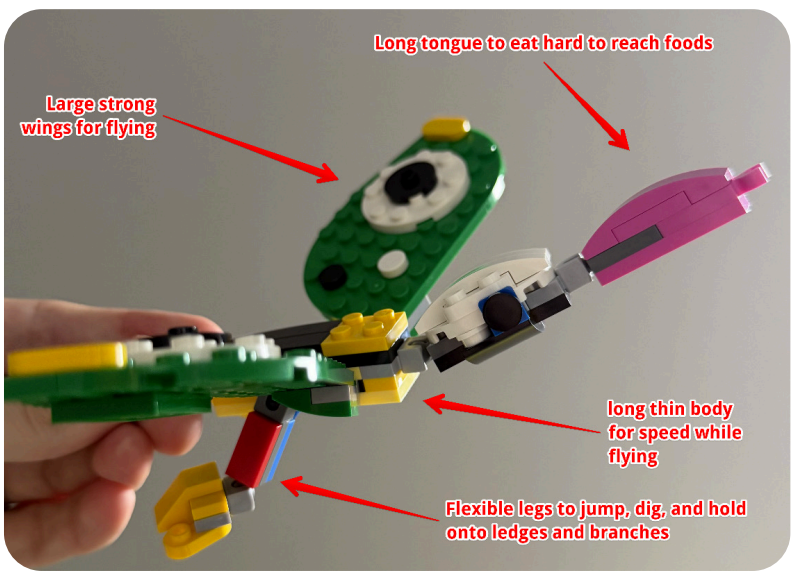
The following **key questions** can help groups to think about the design of their creature:

1. ***Emergent Layer:*** If your creature lives in the Emergent Layer, it needs to withstand intense heat and wind. These creatures will need large wings or strong "gripping" feet for the skyscraper trees.
2. ***Canopy Layer:*** This is the "big green roof" where sloths and parrots live. Think about camouflage, and how creatures stay hidden. Could your team use the green LEGO pieces to show how animals blend into the lush leaves to hide from predators like Harpy Eagles.
3. ***Understorey Layer:*** It is darker and cooler here. Because it is dark and shaded how does your creature find food? Does it have big eyes or use sound? (e.g., Sensory Adaptations)
4. ***Forest Floor:*** This layer is dark, damp, and full of leaf litter. Think about the "creepy-crawlies" that turn dead leaves into compost in Irish woodland floors and rainforest floors.

In their teams, learners assemble a new 'creature' using the different body parts available. Learners could work in their teams, or subdivide into smaller groups/pairs.

Emphasise to the class that they are going to have to introduce their newly discovered living thing to the class, and explain how it has adapted to its habitat.

Learners might assemble creatures like the following example, and be able to explain the purpose of each body part:





Sharing & Discussion
[10 minutes]

Teams or pairs could first present their creature to another team or pair.

In the role of wildlife biologists, teams (or pairs) share their newly discovered living things. Encourage non-presenting learners to question what the features of these 'creatures' can tell us about where they live, and how they have adapted.

After the wildlife biologist showcase, ask the learners to think about what they have learnt about the work of wildlife biologists and how animals adapt to survive in their habitats.

Ask each team to reassemble the three animal models, and return all equipment to the Explore Set boxes.

Extension Activities







Printable worksheets for this session are available here: **fll.ie/bioglow**

Consider these ideas for extension activities:

Write a report about their newly discovered living thing. This could emphasise how it has adapted to its habitat or how it is similar/different to an Irish animal.

Animal Adaptations

- Consider adapting lesson materials from the 'Adaptation' section of BirdWatch Ireland's Primary School Action Guide: A Teacher's Guide for Nature Activities materials (pp. 30 - 45) available free here: **https://birdwatchireland.ie/app/uploads/2019/09/BirdWatch-Ireland-LLN-Action-Guide-web.pdf**
- Learn more about how animals adapt to their habitats by watching this compilation of **BBC Earth's Top 5 Most Remarkable Animal Adaptations**

Wildlife Biologist:

- Dr Stephanie Manka has prepared a playlist of videos which address a lot of the questions learners may ask about this career, e.g., what do wildlife biologists do on a daily basis? What do I need to study in school to become a wildlife biologist? **https://www.youtube.com/playlist?list=PLq0ykM1DSnlQbTiVPQ1TssyqRlbFabwKG**
- In particular, the following video addresses a lot of common misconceptions about the work of a wildlife biologist: **What is a Wildlife Biologist? Your FAQs answered**



Session 6: How Bioacousticians use Sound Sensors

Purpose:

Learners will explore the work of bioacousticians and how they use sound sensors. They will also develop an understanding of how sensors work through building, coding & adapting a LEGO project.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Develop an understanding of, and appreciation for, how sound sensors can be used to detect rare and shy species that scientists cannot always see.
2. Build and code a LEGO robot.
3. Experiment with cause and effect relationships using the sensor blocks.
4. Develop a deeper understanding of code and computational thinking by testing and adapting prototypes.

Learners will build:

LEGO SPIKE Essential

- Lesson 1 - Animal Alarm

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Note to Teachers:

- This session contains the first guided build and code activity using the LEGO SPIKE Essential kit. If your class is new to this equipment, you may want to first complete the tutorial activities in the LEGO Education SPIKE Essential app.
- It is also important to allow time in this session for teams to document what they have built and programmed, how they did this, and what they learnt. These reflections will be very helpful as the class moves toward building their team models.

Resources

- LEGO Education SPIKE Essential set
- Digital Device
- All digital and printable resources for this session are available: **fll.ie/bioglow**

Digital resources:

- **Nature Sound Video**
- **Bioacoustic Device Video**
- Images of Bioacoustic device

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Geography • Mathematics • Visual Arts • SPHE • Language (English) • History	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 35 for full details of Subject, Strands, Strand Units and Skills	

Introduction
[10 minutes]



Sounds in the Wild [5 minutes approx]

Day and night, the wild world is full of amazing noises! From the deep rumble of an elephant to the tiny chirp of a cricket, animals are constantly making sounds.

A scientist who specialises in the study of these sounds is called a bioacoustician. Explain to learners that you can think of a **bioacoustician** as a nature detective who uses their ears! They listen closely to figure out how animals talk to each other, laugh, warn their friends about danger, and even find their way around in the pitch-black darkness.

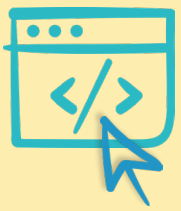
By listening to these secret animal languages, these scientists can learn where animals are hiding, how they are feeling, and how we can help protect them.

Before we learn about the devices these sound-detectives use to listen to nature, let's test our own ears! Watch this short video quiz to see how many local birds and animals from around Ireland and the UK learners can recognise just by listening to their calls.

Introduction

Resource(s):

- **Nature Sound Video**





The following prompts may support:

Before watching:

1. *Ask learners to close their eyes. Imagine if you walk outside your home or school late at night, what animals do they think they might hear in Ireland?*
2. *Why do you think animals make sounds at all?*

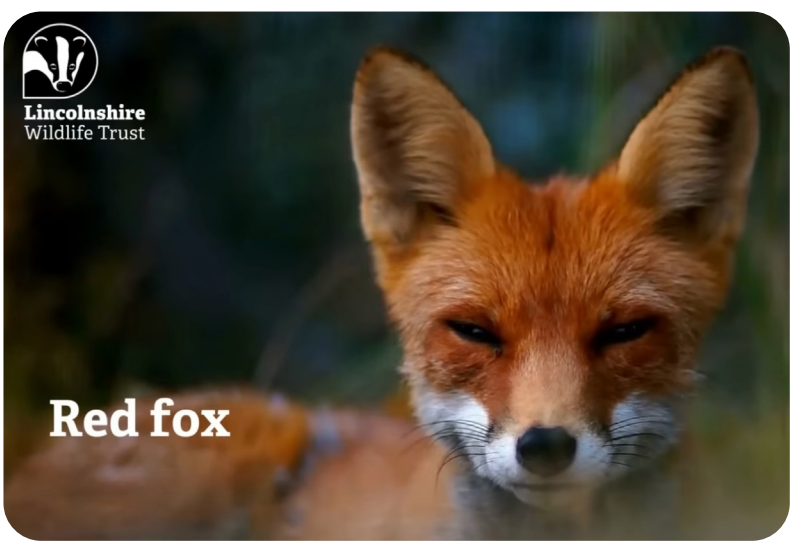
Nature Sound Video (0:00 - 1:46)

While watching:

1. *Make note of how many species you can identify.*

After watching:

1. *If you were an Irish bioacoustician, how could you figure out which animals live nearby without ever seeing or hearing them? Discuss in pairs/groups and share with the class.*
2. *Modern bioacousticians don't just look for footprints; they use technology to track and monitor nature. What kind of high-tech devices or tools do you think scientists use to track and record Irish wildlife without disturbing them?*
3. *If you were using this technology to track an incredibly rare or endangered animal perhaps hiding deep in a jungle or a desert outside of Ireland, how would you find it? What extra challenges would you face compared to tracking a fox in an Irish field?*



Introduction





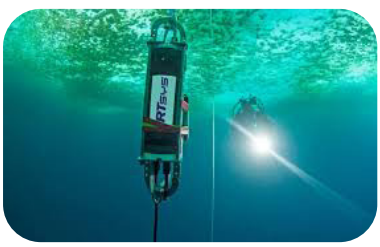
Bioacoustics: How bioacousticians use Sound Technology [5 minutes approx]

Bioacoustics is the scientific field that uses sound technology to track, listen to, and protect rare or endangered species. Because many rare animals are experts at hiding, scientists use special microphone devices to capture their voices, calls, and footsteps without disturbing them. The process relies on three main steps:

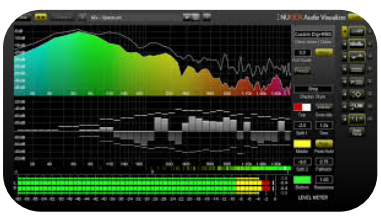
1. ***Listen***: Small, weatherproof recorders are tied to trees or placed underwater.



2. ***Record***: These technologies are called "Passive Acoustic Monitors" (PAMs), and they record the noises around them for weeks, or even months.



3. ***Analyse***: Special computer programmes turn the recorded sounds into pictures so scientists can "see" the noise and figure out which animal made it.

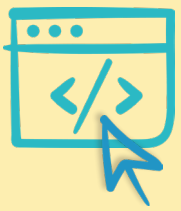




Introduction

Resource(s):

- **Technology and Conservation Management: Bioacoustic Monitoring**





Let's focus on the listening devices: Passive Acoustic Monitors (PAMs).

The following video excerpt can be played for more information, if needed: **Technology and Conservation Management: Bioacoustic Monitoring** (approx 02:18-04:30).



Present two considerations for the learners to discuss in pairs/groups with their 'engineering' hats on! In each case, instruct learners to discuss first, and then write down two reasons.

1: The Invisible Listener

If scientists are trying to listen to very shy, rare animals (like a pine marten in Ireland or a tiger in Asia), why is leaving a small **PAM box** tied to a tree much better than having a human scientist sit there with a microphone?

2. The Weatherproof Mystery

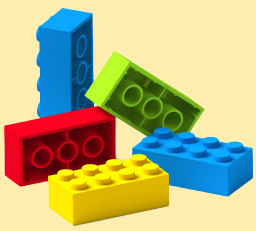
Look at the description for step 1 (**Listen**). It says these recorders are "weatherproof" and can even be placed "underwater."

- *If you look at the technology we use every day, what would happen to a normal tablet, smartphone, or laptop if you tied it to a tree in the Irish rain or threw it into the sea?*
- *Brainstorm together: What special features do you think a PAM box needs to have on the outside to survive months in the wild?*

Development
[40 minutes]

Classroom Oganisation:
- Divide learners into groups of four or fewer while using LEGO materials.

Resource(s):
- LEGO Education Set (SPIKE Essential)
- Digital Device



Teacher Tip:

Remember that the sound comes from the digital device, not from the hub. Learners may need to turn up the volume on the device

Building and Coding a Sensor using LEGO Robotics

Explain to the class that we are now going to think more about sensor technology just like scientists do when they are tracking rare or shy species. This time, with inspiration from our class designs, we will build and code a model which uses a sensor to react when something is detected. Then we will adapt this so that it can be used to detect a particular species.

Purpose of the Builds:

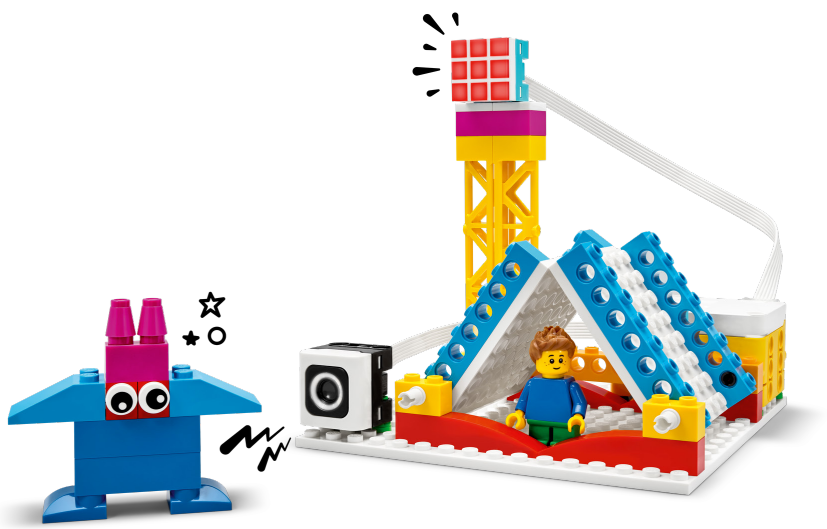
- To introduce the sensor and sensor code block.
- Explore how the sensor and sensor code block function.
- Adapt their sensor build so that it can be used by a scientist to track rare or shy species.

💡If your class is new to coding, you may want to begin by completing the tutorial activities in the LEGO Education SPIKE Essential app💡

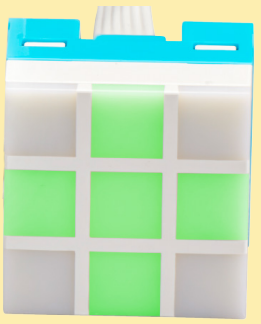
1. Guided Build and Code [20 minutes approx]**:**

In teams, learners engage with the LEGO Education classroom project:

a. SPIKE Essential - Animal Alarm



Development







2. Coding Challenge Activities [10 minutes approx]**:**

Once the basic build has been completed, set the following tasks which challenge the learners to explore how the coding works and how it can be changed.

It is important to emphasise to learners that this is not a case of trial and error; they are working like engineers here by making a change, testing it and then learning from this process. Encourage learners to document the program (code blocks) they are trying as they may use these sensors again in later sessions.

SPIKE Essential
Animal Alarm challenge tasks

1. Change the colours displayed by the colour light matrix connected to the hub.
2. Create a 'pixel' image on the colour light matrix (e.g. green '+' to signify something was detected; red 'x' if not.
3. Add sound so that when the alarm is activated a sound is also played.
4. Record and add learner-recorded sound (e.g. bird song) to play when the sensor is triggered.
5. Write an algorithm that plays a noise and flashes a light when the sensor is activated.
6. Discuss why it is beneficial to have the alarm provide both visual and audio alerts.

3. Adapting their Sensor Build [10 minutes approx]**:**

Now that the class have built and coded their LEGO sensor model, prompt learners to think about the modern sensor technologies that scientists use to track rare and shy species that we learnt about at the beginning of the session.

Explain to the class that each group will work like engineers to adapt their sensor model so scientists can use it to support their work. Their model is a prototype, and could be bigger or smaller than it is in real life.

Development



Below are some prompt questions to help groups:

- *What specific rare animal is this alarm looking for? How does the LEGO sensor know that exact animal is nearby? (Is it by its size, its sound, or how fast it moves?)*
- *Where and how might the scientist set up the alarm? Will it be hidden high up in a tree, placed on the ground, or carried around like a scanner?*
- *What does the alarm do when it spots the animal? How does it alert the scientist without scaring the animal away? Will it flash a light, make a quiet sound, or send a signal?*
- *How do you stop the alarm from making mistakes? What happens if a regular animal (like a squirrel) walks past it, or if a strong gust of wind blows?*

Coding & Build Guidance for Teachers



Teacher Tips:

1. When using SPIKE Essential, encourage learners to think about how different LED light colours can represent different "tracking events". For example, a blue light could mean the sensor detected water/a water-dwelling animal, while a red light means a rare land animal is nearby.

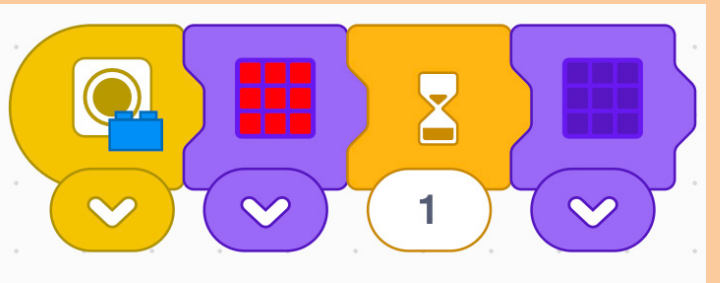
Alternatively, encourage learners to use different light colours to represent "distance". For example, green means the area is clear, yellow means an animal is getting close, and flashing red means a rare species has triggered the alarm!

2. In addition to the Light Matrix, the SPIKE Essential Set also uses a Colour sensor. The Colour sensor can be programmed to detect a specific colour and then react to this. For example, learners can pretend the scientist has tagged a rare animal with a coloured marker. When the LEGO colour sensor spots that specific colour moving past, the alarm triggers to let the scientist know the animal is safe.

Coding & Build Guidance for Teachers

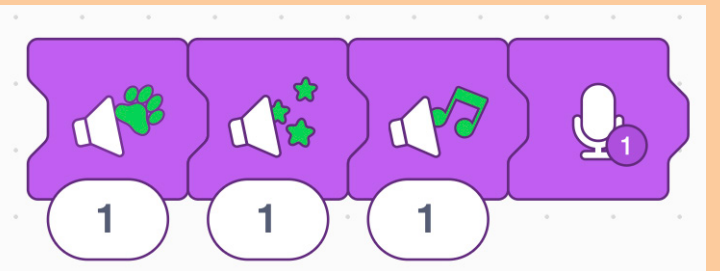


SPIKE Essential: Animal Alarm



Once the colour sensor recognises the colour (blue), the colour light matrix will display a 3 x 3 grid of red lights. After 1 second has passed, the colour light matrix will not display any lights.

This simple algorithm (code) can be tinkered with in order to make the 'alarm' more effective by including both lights and sound. The additional code blocks for sound in SPIKE Essential are shown below.



Guiding questions:

- *Can you change the sound the robot makes?*
- *What might happen if you change the number under some or all of the blocks?*
- *Can you see any blocks that might make the robot turn on a light?*
- *Can you change the colour of the light?*
- *Can you make the robot play a sound and flash a light one after the other?*
- *Can you change the order of the sound and the light?*



Closure *(Document/ Share/Tidy up)*
[10 min]



Resource(s):

- Digital Portfolio
- Digital Device



Note to Teachers:
It is important to allow time for teams to document what they have built and programmed, how they did this, and what they learnt. These reflections will be very helpful as the class moves toward building their team models.

1. **Document** [5 minutes approx]**:**
   a. Each team documents and reflects upon their sensor prototype - **adding photos, videos, notes to their digital portfolios.**
   b. Consider how they built it, how it works, how they might change or adapt or improve it.
   c. In particular, document how they got the sensor program (code) to work; and how they adapted this.

2. **Share:**
   a. What they built, and how it could be used by a scientist to detect rare or shy species.
   b. Show the coding skills they learned
      i. Explain how they changed the program
      ii. Explain a problem they faced or overcame
   c. Demonstrate their solutions

3. **Teams Tidy Up:**
   a. All builds should be disassembled and returned to the LEGO Education Set (SPIKE Essential). *(LEGO SPIKE Essential - parts are colour coded)*



Extension Activities







Engineering Extension task:

Present the class with a design challenge!



The Problem:

Deep in a remote, uncharted jungle thousands of kilometres from Ireland, a legendary, ultra-rare creature has been spotted. Nobody knows what it is, but it leaves behind strange, haunting calls in the dark. We have zero data on it. Why does it make these sounds? Is it warning others, hunting, or just singing? Does it only wake up at midnight? Your team of bioacousticians has been chosen to fly out and explore more..

Team Design Challenge:

Before you step foot on the plane, your team must design (and label) a **Super-PAM (Passive Acoustic Monitor)**. This isn't just a microphone; it's a high-tech listening device that you will hide in the jungle to record the creature's secret life.



Note: The jungle is a brutal place. Your Super-PAM needs to survive torrential downpours, curious monkeys, and thick mud, but it also needs to be light enough for you to carry through miles of dense vines. Your team might need to consider these important questions:

- ***Power:*** How will it stay turned on for weeks without you changing the batteries?
- ***Defence:*** How will you protect the delicate tech from heavy rain, humidity, and other wild animals?
- ***Stealth:*** How will you hide it so the creature doesn't notice it?
- ***Audio:*** How will it capture crystal-clear sounds from far away?

Extension Activities



Be ready to share your designs with the class, so everyone can get some ideas for the next challenge!

Consider these further ideas for extension activities:

- ***STEM/Geography:*** Go on a class "Sound Walk" in the school locality. Create a sound map. Stop and listen at intervals for three minutes. Draw a circle on a paper representing you. Every time you hear a sound (a bird chirping, a bee buzzing, a dog barking), draw a symbol for it on the paper exactly in the direction the sound came from.
- ***Science:*** Investigate how the sensors used in the LEGO builds work by conducting experiments relating to light and sound.
- ***Literacy:*** Your team's design challenge is successful and award winning. You decide that other bioacousticians might like to buy it and use it in their studies too. Create a colourful and descriptive advertisement to attract new buyers. Don't forget, it has to be priced competitively in order to sell well!
- ***STEM/Geography:*** Ireland is home to a number of rare Dark Sky areas, unpolluted by artificial light. If you live in one of these areas could you create a sound map in the locality? What sounds do you think we might hear that we might not in another non-Dark Sky area?
  https://www.darksky.ie/



Session 7: The Wildlife Biologist - Tasks and Tools

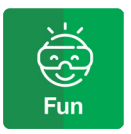
Purpose:

Learners will explore the work of wildlife biologists and the tools they use to understand how rare species live, interact, and survive. They will also explore how to build and code a LEGO Tree House and adapt it into an imaginary research observation station.

Core Values:









Learning outcomes:

Learners will be enabled to

1. Develop an understanding of, and appreciation for the work of wildlife biologists as in learning about rare species that live, interact and survive high up in the rainforest.
2. Build and code a LEGO robot.
3. Experiment with cause and effect relationships using the motor blocks.
4. Develop a deeper understanding of code and computational thinking by testing and adapting prototypes.

Learners will build:

LEGO SPIKE Essential

- Lesson 2 - Treehouse Camp

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Resources

- LEGO Education SPIKE Essential set
- Digital Device
- All digital and printable resources for this session are available: **fll.ie/bioglow**

Digital resources:

- **Behind the scenes of setting up a research observation deck video**
- Tasks and tools of a Wildlife Biologist - Images

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Geography • Music • Visual Arts • SPHE • Language (English) • Mathematics • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 36 for full details of Subject, Strands, Strand Units and Skills	



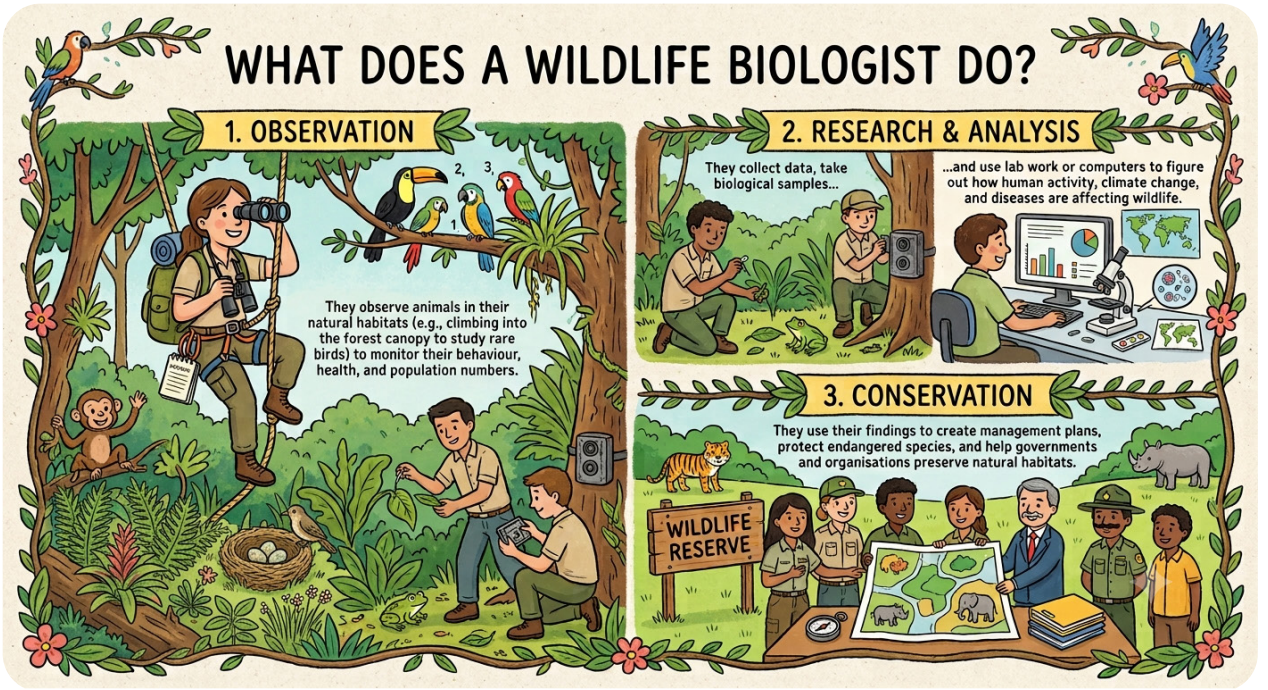
Introduction
[10 minutes]

The tasks and tools of a wildlife biologist

Ask the class if they can remember what type of scientist studies the living world to understand how plants, animals, and tiny organisms survive and thrive.

A **wildlife biologist** is a scientist who studies wild / rare animals and their ecosystems to understand how they live, interact, and survive.

Their job breaks down into three main areas. Share the visual below with the class (if possible on a large screen/ Interactive whiteboard or on student digital devices):



Introduction



The following guiding questions could be used to encourage the learners to think about each of the roles in more detail and/or conduct some further research:

1. ***Observation:*** If you were a wildlife biologist, which part of that job would you find more exciting: climbing high into the trees to listen for / watch rare birds, or setting up a hidden camera to capture a video of a shy jungle species closer to the ground?
2. ***Research & Analysis:*** Look at the graphs and the microscope. Why is it important for wildlife biologists to use lab work and computers? What kinds of things can a computer or a microscope teach them that binoculars can't?
3. ***Conservation:*** This is about protecting animals. Why is it important for wildlife biologists to talk to the local people and the people who work for the government, not just the other scientists? *(This is the focus of Session 7)*

Although a wildlife biologist's job is incredibly exciting, working in dense wild areas comes with major challenges. Think back to what we discovered about the different layers of a rainforest (Session 3 and Session 4). Ask learners to imagine they are a team of wildlife biologists heading into a tropical rainforest near the equator. Their mission is to track and monitor rare species that live high up in the trees. Because it is so difficult to see through the thick branches from the forest floor, they will need to get closer to the action.

What essential tools will they need to bring with them?

Ask learners to make suggestions before introducing them to some tools/devices used by wildlife biologists:

Introduction



1. Heavy-Duty Climbing Ropes and Harnesses

Before a biologist can use any scientific equipment, they have to get up into the trees safely! Because canopy trees can be as tall as a 10-storey building, scientists use advanced rock-climbing equipment.

How do wildlife biologists do this?

They use giant slingshots or crossbows to fire a thin line over a strong, high branch, which they then use to pull up heavy climbing ropes. Once secure, they wear a padded harness and use special metal clips (called ascenders) to slide up the rope without having to use all their muscle power.



2. Canopy Cameras

A rugged, weatherproof camera strapped to a tree trunk. It is well camouflaged and has a special motion sensor (like the one that turns on automatic lights at home).

Why are these cameras useful?

Wild and rare animals are often terrified of humans, but they don't mind a quiet camera. When a rare bird lands on a branch or a tree-kangaroo climbs past, the camera automatically snaps a photo or records a video. This lets wildlife biologists monitor the animals 24 hours a day, even when the scientists are asleep on their observation deck.









3. High-Power Binoculars and Spotting Scopes

The canopy layer is vast, and a biologist on a platform can't climb to every single branch.

How does this equipment help?

Super-strong binoculars act like magnifying glasses for the eyes. They allow biologists to sit quietly on their research deck and read the tiny numbers on a bird's leg tag, count the eggs in a distant nest, or watch exactly what kind of fruit a rare monkey is eating, all without scaring the animal away.



4. Rulers & Calipers

When biologists get close enough to a living creature they use tools like rulers and calipers.

How does this equipment help?

Biologists can't just guess details about the creatures they study, they need to be precise. They use tools like rulers and calipers to collect "clues" (or data) about the creatures they find.

They use these to:

- Track growth and see how much a creature has grown.
- To identify species and recognise differences between creatures.
- To check the health of creatures. For example, if a bird's wing is smaller than usual, it might be a clue that the bird isn't finding enough food in its habitat.

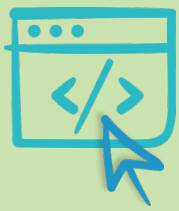




Introduction

Resource(s):

- **YouTube video**



Note to Teacher:

Discussion of these tools/devices is an opportunity to build learner awareness of the range of digital and non-digital technologies used by wildlife biologists, and the purpose they serve in their work. This directly links with the Learning Outcomes of the Technology Strand of the STEM Curriculum (DEY, 2025, p. 24).

For a "behind the scenes" view of setting up and filming from a research observation deck, learners might also enjoy this short **YouTube video** which shows the challenges for researchers and crews. Play from 0:18 to 4:56 approx.



This video shows how the tools that wildlife biologists use can be so helpful if they want to work above ground level on a research deck or at an observation station.

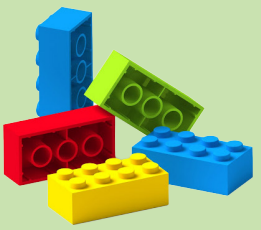
Post viewing question prompts:

1. *Think about how high up that branch was. Why is it not enough to just climb up a tree—what else do you need to do to make sure both the scientist and their heavy tools don't fall or sway in the wind?*
2. *If you are sitting on a single tree branch for days to listen for and watch wildlife, what problems would your body face, and what would you need to build to make your work actually possible?*

Decks and stations come in all shapes and sizes including elevated platforms, suspension walkways, or canopy towers constructed for scientific observation and ecological data collection in the upper layers of a tropical or temperate forest.



Development



Resource(s):

- LEGO Education Set (SPIKE Essential)
- Digital Device



Build a Tree House Camp

Explain to the class that we are going to build a Tree House Camp and then adapt it so that it could be used by wildlife biologists to observe species in vertical habitats.

Purpose of the builds:

- To introduce the motor and motor code blocks.
- Explore how the motor and motor code block function.
- Adapt their motor build so that it can be used by a wildlife biologist to observe species in vertical habitats.

1. Guided Build and Code:

In teams, learners engage with the LEGO Education classroom project:

a. SPIKE Essential - Tree House Camp





Development



2. Coding Challenge Activities:

Once the basic Tree House build has been completed, set the following tasks which challenge the learners to explore how the coding works and how it can be changed.

SPIKE Essential
Tree House Camp challenge tasks

1. Make the tree house roof open and close.
2. Adjust the angle of the roof's movement.
3. Change the motor speed. What do you observe?
4. Add a sensor to the LEGO Tree House Camp and complete the following tasks:
   a. Code the tree house roof to automatically close when a specific colour or object is held near the sensor (simulating a "night time" or "rainy day" trigger).
   b. Record and add a learner-recorded sound (e.g., sounds made by particular species) to play the exact moment the sensor triggers the roof to open.
   c. Write an algorithm that plays a warning noise and flashes a specific pattern on the Light Matrix when the sensor is activated.
5. Remind learners from a previous session (5) why it is beneficial to have the sensor provide both visual and audio alerts.

Discussion point: Explain that in a busy or noisy camping environment, an audio alert (the noise) ensures people know the roof is moving even if they aren't looking at it, while a visual alert (the flashing light) helps someone who might be wearing headphones or who has hearing difficulties stay aware of the physical changes in the environment.



Development



3. Adapting Tree House Camp

Now that the class have built and coded their LEGO tree house camp model, prompt learners to think creatively about how it could be used as a specialised research station, used to safely observe vertical habitats and collect data from rare or shy species.

Explain to the class that each group will work like engineers to adapt their tree house camp model so that wildlife biologists can use it to support their work at different elevations.

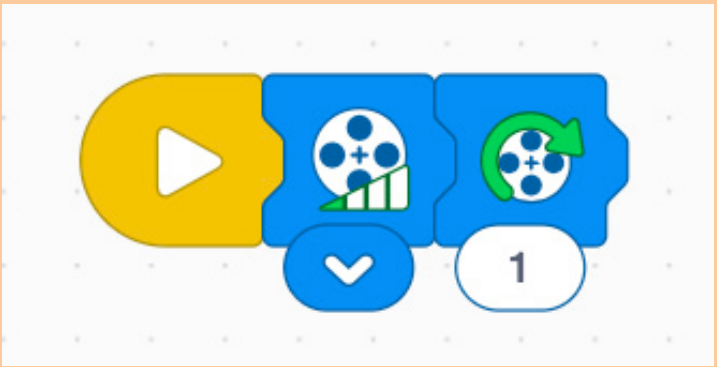
Scaffold and prompt this task with the following questions:

- *How will a wildlife biologist use your tree house research station?*
    - *Lifting heavy field equipment up into the canopy?*
    - *Carefully lowering a fragile camera to a lower branch?*
    - *Pulling up leaf and soil samples from high branches?*
    - *Sifting or sorting through forest debris to find insects?*
- *What types of weather, canopy layers, or environments will your research station be working in? How will you adapt your tree house to suit these conditions? (e.g. adding a waterproof canopy for rainy weather; reinforcing the structure for high winds; changing the size/height to fit between dense branches).*
- *What physical (engineering) changes will you make to your model? (e.g. building a motorised winch/pulley system; modifying the roof).*
- *What changes will you make to your tree house's algorithm (code)? (e.g. changing motor directions, timing the lifting mechanism, or adjusting the speed to keep equipment stable).*
- *What could you add to improve your research station? (e.g. a colour sensor to detect passing animals; the LED matrix to signal scientists at night; sound recordings of animal warnings or alerts).*



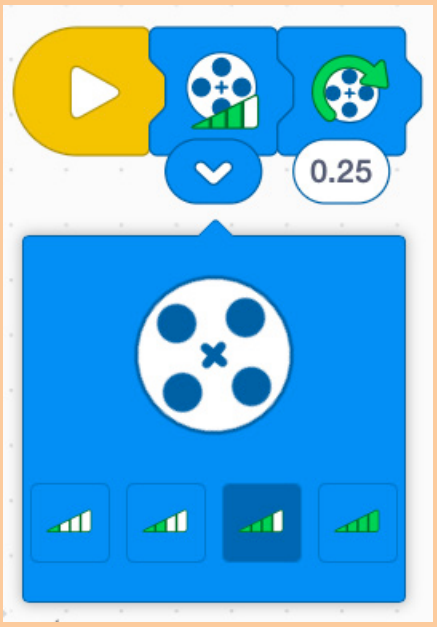


SPIKE Essential: Tree House Camp: Rotating open/closed



This programme begins by setting the motor power. It then sets the rotation of the motor clockwise, to move the roof from a 'closed' to an 'open' position. In the above example, with the number under the rotation set to 1, it might open the roof too much. The angle can be adjusted using decimal points to the desired distance eg 0.5, 0.25 etc (click on the number to edit accordingly).

SPIKE Essential: Tree House Camp: Change Speed/Direction



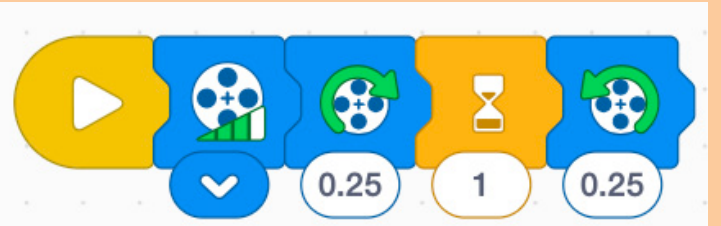
This simple algorithm (code) can be tinkered with in order to make the model move more quickly / slowly, to change the direction of movement (clockwise to open / anti-clockwise to close), and to change how long / short the motor stays open (duration).



Coding & Build Guidance for Teachers

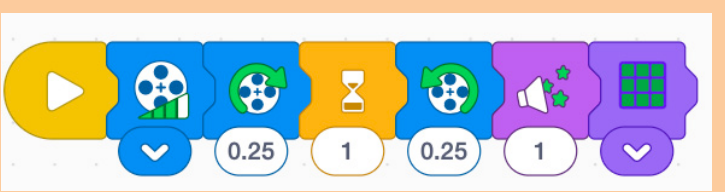


SPIKE Essential: Tree House Camp: Change Duration/Wait times



The above algorithm can also be extended in different ways. In this example, a wait time has been added so that the roof stays open for 1 second before it is programmed to close again.

SPIKE Essential: Tree House Camp: Add Sensors / Sound



The algorithm could be further adapted to add sensors and sound and / or lights. The example here extends the code by playing a sound and turning the light matrix green after the roof has closed. See the coding guidance in Session 6 and/ or the SPIKE app for further support & examples.

Guiding questions:

- *Can you tinker with the code in order to make the motor run for a longer/shorter duration?*
- *Can you change the code to make the roof move faster/slower?*
- *I wonder what might happen if you change the number under the different coding blocks?*
- *Can you see any blocks that might make the motor change direction? Why might this be useful?*
- *I wonder if you could make your specialised research centre play a sound and/or flash a light to warn that something is about to happen e.g. the roof open/close?*
- *I wonder if you could change the order of sound and light?*



Closure (Document/ Share/Tidy up) [10 minutes]



Resource(s):

- Digital Portfolio
- Digital Device

Document:

1. Each team documents and reflects upon their tree house prototype - adding photos, videos, notes to their digital portfolios.
2. Consider how they built it, how it works, how they might change or adapt or improve it.

Share:

1. What they built, and how it could be used by a wildlife biologist to detect rare or shy species and collect data for their research.
2. Show the coding skills they learned.
   a. Explain how they changed the program.
   b. Explain a problem they faced or overcame.
3. Demonstrate their solutions.

Teams tidy up:

1. All prototypes should be taken apart and returned to the LEGO Education Set (SPIKE Essential).

Extension Activities





Consider these ideas for extension activities:

Literacy: "A Day in the Life of a Wildlife Biologist". In pairs, learners imagine they have been asked to interview a wildlife biologist for an important upcoming TV documentary. One student acts as the TV presenter, and the other plays the canopy scientist. They must include three dramatic "behind-the-scenes" secrets about what it's really like to sleep, eat, and survive a massive storm on a tiny platform high in the rainforest! Visit National Geographic Kids for lots of inspiration!

STEM / Visual Arts: "The Canopy Blueprint". In pairs, learners are invited to work as structural engineers to design a high-tech treetop research station. They must sketch a detailed blueprint for the ultimate canopy deck, labeling three clever safety features that stop their heavy equipment from plummeting into the jungle, and a secret design trick that keeps the platform completely steady when the wild rainforest winds blow!

Science & Technology (STEM): "Powering the Platform". In pairs, learners work like engineers tasked with lifting heavy gear up to the treetop station. Using LEGO motors, gears, and/or classroom materials, they must build and test a miniature lifting system. They will run experiments with pulleys and levers to discover how changing the design makes it easier to hoist heavy weights into the air, finding the perfect balance between motor speed and lifting force!

Session 8: Wildlife Conservation

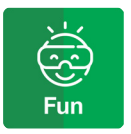
Purpose:

Learners will develop an understanding of wildlife conservation and why preservation and restoration are so important for biodiversity. They will also build and adapt a lifting platform which uses motors, sensors and outputs.

Core Values:









Learning outcomes:

Learners will be enabled to

1. Develop an understanding of wildlife conservation and why it is important for preserving, protecting and restoring biodiversity and ecosystems.
2. Apply their understanding of motors, sensors and if/then statements while building, adapting and programming a lifting platform model.

Learners will build:

LEGO SPIKE Essential

- Lifting Platform from the Explore Set

Progress:

1 2 3 4 5 6 7 **8** 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Geography • Visual Arts • SPHE • Language (English) • History • Mathematics	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 38 for full details of Subject, Strands, Strand Units and Skills	

Resources

- Book 2 and Bag 7 from the Explore Set
- Brown base plate (8x8) from the Explore Set
- Smart Hub and motor from the LEGO Education SPIKE Essential set
- Digital Device
- Prototyping LEGO elements (Bags 9 - 13) from the Explore Set can be used to improve the Lifting Platform.

Digital Resources:

- **Book Creator** - Digital Book / Storytelling Tool
- **Vocaroo** - Online Voice Recording (Podcast) Tool
- **Swift boxes video from OPW Ireland** (0:00 - 2:50)



Introduction
[5 minutes]

Conservation

Conservation is the careful protection, preservation, and management of natural resources, environments, and wildlife. It aims to prevent exploitation and destruction, ensuring that ecosystems and limited resources (like water, energy, and soil) are used sustainably so they persist for ourselves andfor future generations.

Introduction



Conservation means taking care of the Earth!

It works in two ways: **preservation**, which is protecting nature where it already exists and **restoration**, which is helping damaged ecosystems return to a healthy state.

Restoration might actually involve removing wildlife like trees if they've been planted in the wrong place!.



Ask learners to look carefully at both sides of this rainforest picture with the following questions in mind:

- *What is happening in the Preservation picture?*
- *What is happening in the Restoration picture?*

In pairs, learners then discuss and share ideas on the following guiding questions:

Preservation

- *How does protecting a forest keep both wild animals and humans safe and healthy?*
- *Why is it easier to take care of nature now rather than trying to fix it after it gets damaged?*

Restoration

- *If you were a scientist trying to fix a damaged habitat, why would you need to do hands-on work (like planting trees) and smart tracking (like counting birds or testing the water)?*
- *Why can't you just do one without the other?*



Development
[45 minutes]



Resource(s):

- **Swift boxes video from OPW Ireland** (0:00 - 2:50)

Swifts - Endangered Species and Swift Boxes [10min approx]

Now that the class has discussed the importance of conservation for wild ecosystems of the world, remind learners that conservation is equally important here in Ireland. Let's explore one example: The **swift** which is a migrating bird, is now 'endangered' in Ireland due to a habitat crisis.

The **swift** is a small, dark-brown bird, shaped like a pointy boomerang that visits Ireland every summer from Africa to lay its eggs. These incredible birds spend almost their entire lives flying without ever touching the ground. They even eat, drink, and sleep while zooming through the air!



Share the **Swift Box video** from the Office of Public Works (OPW) with the class. It highlights why swifts have become endangered because there are fewer places for them to live (loss of habitat) and the steps that are being taken around Ireland to preserve and restore their numbers (swift boxes).

Increasing the number of pollinators, like we suggested in previous sessions, also benefits swifts since it increases their food source!



Development





After watching the video, ask the class to consider:

The Problem - Endangered Species

- *What is the problem or concern (e.g., Swifts are on the endangered list - loss of habitat a major cause)*
- *How are the OPW trying to help?*
- *Do you think this is preservation or restoration? Why so?*

Preservation and Restoration - Swift Boxes in Ireland

- *Where were the bird boxes placed? Why do you think these positions were chosen? (e.g., high, to avoid predators)*
- *What might be a challenge for the scientists? (Access)*
- *How Research and Technologies can Help*
- *What else did you notice about the boxes? (Numbers)*

How might numbering the boxes help scientists? (Tracking)

- *If you were a scientist, what else could you do to increase the Swift numbers?*
- *Remind the class that in the video we saw the Swift bird boxes being placed up high in different kinds of locations around Ireland.*





Development





Swift bird boxes in modern buildings and ancient buildings (Clonmacnoise Monastery)

In our next LEGO build we have been tasked with working like engineers to build and then improve a Lifting Platform to help conservation scientists and wildlife biologists to access bird boxes which have been placed in difficult to reach spots that can be very high up.

Background information for Teachers:

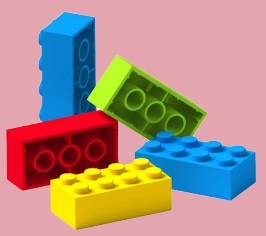
The **Office of Public Works (OPW)** manages the Government's estate portfolio, maintaining and presenting Ireland's built heritage.

This includes maintaining and presenting iconic heritage properties, including two UNESCO world heritage locations of Sceilg Mhichíl and Brú na Bóinne, 780 national monuments and over 5,000 acres of gardens and parklands. As well as managing 2,500 State properties, including around 530 office buildings for civil servants and more than 680 Garda bases.

Birdwatch Ireland This year Birdwatch Ireland celebrates 50 years of conservation work in Ireland. The '**teacher page**' on the website contains many interesting resources for classes to explore.



Development
(Build)



Resource(s):

- Book 2 and Bag 7 from the Explore Set
- Brown base plate (8x8) from the Explore Set
- Smart Hub and motor from the LEGO Education SPIKE Essential set
- Digital Device
- Prototyping LEGO elements (Bags 9 - 13) from the Explore Set can be used to improve the Lifting Platform.



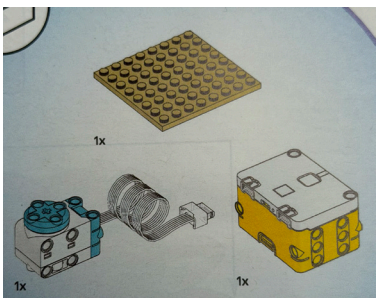
Purpose of the builds:

- To enable learners to apply previously developed computational thinking skills in a new context (i.e., programming the motor)
- Further explore how the motor and motor code block function.
- Adapt and improve their Lifting Platform by considering purpose and audience.

Build the Lifting Platform model
[15 minutes approx]

Divide the class into teams. Each team will need Book 2, Bag 7 and a small brown base plate from the Explore Set. Teams will also need the Smart Hub and a motor from the SPIKE Essential kit.

Instruct each team to build the lifting platform model, this will take approximately 15 minutes.





There are two minifigures in Bag 7

Code the Lifting Platform model [10 minutes approx]

Once the model has been built, ask learners to think about the following:

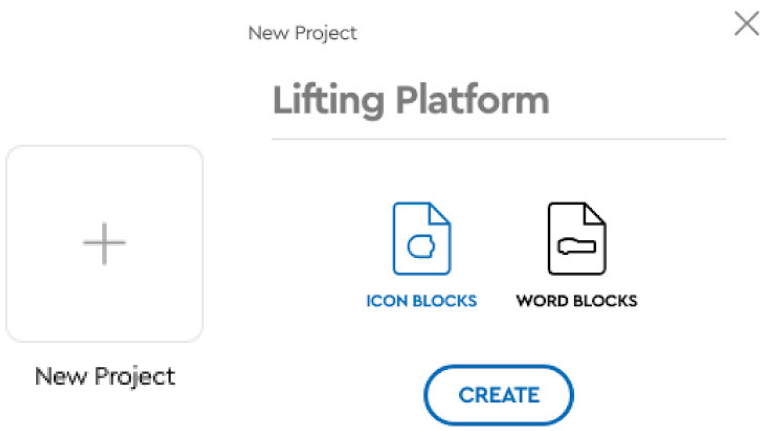
- *What does this model do?*
- *What parts move?*
- *What is changing when these parts move (i.e. angles between the legs)*
- *What causes the movement? (i.e., the motor)*
- *Are there any sensors used?*

Draw learner attention to how this model is engineered to ascend and descend as the motor turns the gears connected to the bottom of the platform legs.

Development
(Build)



Next, challenge the learners to program the lifting platform to ascend and descend. Teams will need a digital device to program their model using the SPIKE Essential app. Rather than following a prepared lesson, learners will open a new blank project to program their model. Direct them to name the project and select 'icon blocks'.



Learners can be prompted to think back to the previous session where they programmed the Tree House Camp to open and close.



How could they use what they already learnt to program the motor to turn, and cause the lifting platform to ascend.

Once the platform has ascended, how could they change the program to cause it to descend?

Draw learner attention to the **pattern** in these **algorithms**, when the motor turns one direction the platform goes up, and when the motor turns the opposite direction the platform goes down.

As in previous sessions, it is important to emphasise to learners that this is not a case of trial and error; they are working like engineers here by making a change, testing it and then learning from this process. Encourage learners to document the program (code blocks) they are trying as they will be used again in later sessions.

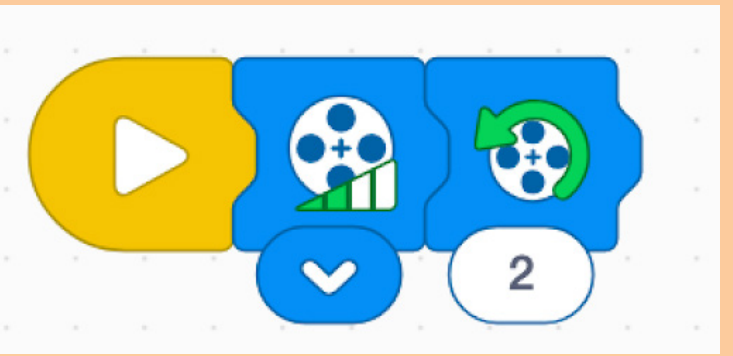


Development
(Build)





SPIKE Essential Lifting Platform



This program begins by setting the motor power. It then sets the rotation of the motor anti-clockwise, to move the lifting platform from a 'down' position, to a raised position. In the above example, with the number under the rotation set to 2, it might turn the motor too much for the length of the lifting platform legs. The angle can be adjusted using decimal points to the desired distance eg 0.5, 0.25 etc (click on the number to edit accordingly).

The speed can also be changed by adjusting the first blue block above.



Direct learners to watch how the model works. Can they describe how it works in their own words?

Notice how the motor is connected to a gear, which is connected to the teeth of the white rack. This rack moves forwards or backwards and causes the legs of the lifting platform to move closer or farther apart. This causes the platform to descend or ascend.

This mechanism is called a ***rack and pinion system***.



Improving the Lifting Platform model
[10 minutes approx]

Now that the class have built and coded their lifting platform model, prompt learners to think creatively about how it could be used by conservation scientists in their work. Divide the class into small groups or pairs and ask them to think-pair-share about what improvements could be made to improve the lifting platform.

Some considerations to scaffold learner discussion:

Safety - how could the safety of the lifting platform be improved?

- *It currently has two small rails, could more be added?*
- *Is there any way to warn people around the bottom of the lifting platform when the platform is ascending and descending? Could sound or lights be added?*

Efficiency - could the lifting platform's design or program be improved to make it work better? Consider

- *Motor speed*
- *Automation - could a sensor be added to automate the movement of the lifting platform?*

Accessibility - can the lifting platform be used by people with reduced mobility?

- *How could this be addressed? E.g., ramp access*

Other uses of the Lifting Platform to support conservation?

- *How might a wildlife biologist use the lifting platform? How could it be improved to help them?*
- *How might the Bioacoustician use the lifting platform?*

Development
(Build)

Allow teams time to agree on a plan for their improvements to the Lifting Platform. Rough sketches are encouraged, but some groups may prefer to make changes directly.

Prototyping LEGO elements (Bags 9 - 13) from the Explore Set can be used to improve the Lifting Platform.

Some groups may prefer to only change the program (i.e., code).

Remind groups that they will be presenting and explaining the changes they've made to improve the lifting platform.

Closure (Document/ Share/Tidy up)



Resource(s):

- Digital Portfolio
- Digital Device

Document:

1. Each team documents and reflects upon their lifting platform - adding photos, videos, notes to their digital portfolios.
2. Consider how they built it, how it works, how they might change or adapt or improve it.

Share:

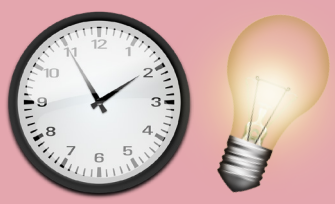
1. How they improved the lifting platformShow the coding skills they learned.
   a. Physical changes and/or changes to the program
   a. How this improvement helps a specific task or career relating to biodiversity.
2. Show the coding skills they learned.
   a. Explain how they changed the program.
   b. Explain a problem they faced or overcame.
3. Demonstrate their solutions.

Teams tidy up:

1. The smart hub and motor should be removed from the lifting platform model and returned to the LEGO Education SPIKE Essential set. The Lifting Platform model can be left assembled as it may be used as part of team projects later in BIOGLOW.



Extension Activities







Consider these ideas for extension activities:

Create a birdbox for your school:

The OPW Biodiversity Unit has curated a number of resources that assist wildlife to roost, breed and hibernate. See below for instructions on how you can create homes for wildlife

https://www.gov.ie/en/office-of-public-works/collections/homes-for-wildlife/

The very short video from OPW below could serve as reminder of what bird boxes look like, where they are typically positioned, and the purpose they serve:

OPW Shorter Swift Bird Box reminder (0:00-0:21).

Geography / Art / Technology:

(You can build on the work you did in Sessions 2 and 3 for this activity) Imagine a local green space in your school or community is under threat or damaged. Working in groups, design a "Dual-Zone Map" for this area. Draw or digitally model a plan split into two zones: a 'Preservation Zone' (e.g., restricted pathways, wildlife corridors, and tech-based bird monitors) and a 'Restoration Zone' (e.g., native Irish wildflower patches, bug hotels, and a community planting area). A useful digital tool to use here is Book Creator for importing sketches / images etc

Literacy / Science / Drama:

Create a 2-minute podcast episode or roleplay interview titled 'Voices from the Rainforest'. Learners work in small groups. 1-3 learners play the role of species returning to the newly restored ecosystem (e.g. Jaguar or Toucan from the poster), while another acts as the interviewer. They must discuss why they left their habit, what they notice has changed between the "damaged" phase and the "restored" phase and how they think that will impact their future. An easy to use recording tool here is **Vocaroo** as it requires no download or account.

Extension Activities

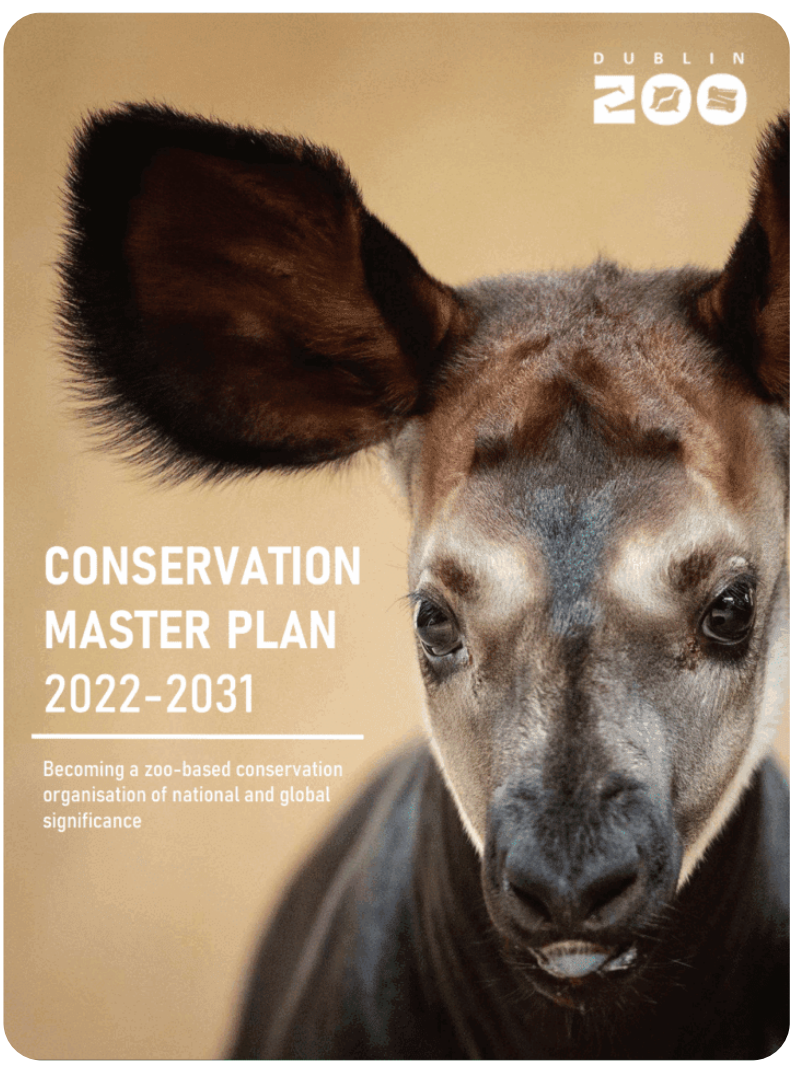


Literacy / Science:
Learn more about Wildlife Conservation in Ireland:

Read and discuss the work of Killian McLaughlin, a leading figure in wildlife conservation efforts in Ireland. As the Founder of Wild Ireland in Donegal, Killian is dedicated to creating a sustainable sanctuary for various species, including bears, wolves, wild boar, and lynx.



https://www.ireland.ie/en/visit/wild-ireland-providing-sustainable-sanctuaries-for-wildlife/





Extension Activities



Exploring the educational resources provided by Dublin Zoo: https://www.dublinzoo.ie/conservation/ Dublin Zoo is committed to being a national focal point for species conservation in Ireland, while contributing meaningfully to global efforts to halt biodiversity loss. Dublin Zoo work alongside conservation partners, governments and communities to protect threatened species, restore habitats and inspire positive action for wildlife.

Preservation (Preventing Damage)

A **"hands-off"** approach to protect healthy ecosystems before they are ruined.

- ***Keeps Habitats Whole:*** Prevents roads or farms from cutting up forests, ensuring animals (like hedgehogs, hares or red deer) have room to hunt and breed.
- ***Locks in Carbon:*** Leaves ancient forests untouched so their massive carbon stores don't escape and worsen climate change.
- ***Protects Water:*** Keeps forest roots intact to act as natural sponges, preventing soil erosion and downstream flooding.

Restoration (Repairing Damage)

An **active** approach to fix environments that are already broken.

- ***Replants for Variety:*** Plants a mix of native trees to bring back local birds and bugs, rather than just planting a single type of commercial tree.
- ***Heals the Soil:*** Uses organic matter and fungi to bring dead, over-farmed dirt back to life.
- ***Reconnects Wildlife***: Builds green corridors or wildlife bridges over or along motorways or roads so isolated animal populations can safely meet and mate.



Session 9: Citizen Science - Using Sensors to Protect Biodiversity

Purpose:

Learners will consider how technology (e.g., sensors) can act as our "eyes and ears" to monitor and protect local biodiversity. They will develop an initial awareness of how collecting and analysing environmental data can help us to protect biodiversity.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Identify how wildlife scientists use technology to monitor and protect biodiversity.
2. Describe what Citizen Science is and explain how regular citizens contribute to global and local scientific databases.
3. Understand how the National Biodiversity Data Centre (NBDC) uses species sightings to protect Irish wildlife through citizen science projects, that often benefit from technology
4. Apply their understanding of sensors and if/then statements while building, adapting and programming a research tool prototype.

Learners will build:

LEGO SPIKE Essential

- Research Device from the Explore Set

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Mathematics • Geography • History • Visual Arts • Language (English) • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 40 for full details of Subject, Strands, Strand Units and Skills	

Resources

- Book 2 and Bag 8 from the Explore Set
- Long red piece from the Explore Set
- Smart Hub and motor from the LEGO Education SPIKE Essential set
- Digital Device
- Prototyping LEGO elements (Bags 9 - 13) from the Explore Set can be used when improving the Research Device model
- **Session 9_CitizenScienceProjects** could be distributed to pairs/small groups to assist in discussing citizen science projects

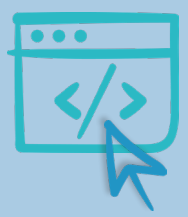
Digital resources:

- **RTE News video** (2:35):
- (Optional) **The story of Cuach KP**
- (Optional) **Cuckoo Tracking Project website**
- **National Biodiversity Data Centre (NBDC) video** (3 min)
- (Optional) Links for Citizen Science Projects:
  - **https://www.irishhedgehogsurvey.com/home**
  - **https://biodiversityireland.ie/surveys/irish-hedgehog-survey/**
  - **https://exploreyourshore.ie/home/**
  - **https://exploreyourshore.ie/surveys/seashore-spotter/**
  - **https://www.batconservationireland.org/what-we-do/monitoring-distribution-projects/ireland-daubentons-bat-waterways-survey**
  - **https://maps.biodiversityireland.ie/Dataset/128/Survey/268**
- **Book Creator** - Digital Book / Storytelling Tool (Optional)
- **Vocaroo** - Online Voice Recording (Podcast) Tool (Optional)

Introduction
[15 minutes]

Resource(s):

- **RTE News video** (2:35):
- (Optional) **The story of Cuach KP**
- (Optional) **Cuckoo Tracking Project website**





Monitoring and Protecting Biodiversity - How technology helps

Explain to learners that in this session, we are going to think a little bit more about how scientists protect biodiversity in Ireland by monitoring and tracking it. To do this, they often rely on technology and, most importantly, they need the help of regular people just like all of us!

Ask the class to consider the inquiry question:

How can technology act as our "eyes and ears" to monitor and protect local biodiversity?

Suggestions:

- EYES: Trail Cameras; Drones; Satellite Images
- EARS: Bioacoustic Recorders; Underwater Microphones

After taking ideas from the class, remind learners of what a 'sensor' is and how sensors could be used by scientists in a variety of ways. Learners can be prompted by thinking back to the 'Animal Alarm' build completed in Session 5. In that build, the alarm only made a noise when the sensor detected movement or a specific colour.

Sensor:
a device that detects or measures a physical property, like light, sound, heat, or movement

Prompt learners to consider why scientists would use sensors:

- To capture data without having to be there
- To record information continuously
- To create a record of sightings/sounds etc.

Introduction



Tracking the journey of Cuckoos from Ireland to Africa [10 minutes approx]



Begin by asking learners if they have ever heard of a bird called a 'Cuckoo'? If so, what do they know?

Show learners the image of the cuckoo and tell them that it has been in decline in Ireland for some time. In order to find out more, using technology, scientists decided to trace the routes of cuckoos as they migrate from Ireland to Africa, and back to Ireland.

The following short **video from RTE News** tells their story (2:35).

While watching the video clip, learners can listen out for the answers to the following questions:

- *How many cuckoos were tagged in Killarney National Park back in 2024?*
  (Answer: 3)
- *What is the name of the first cuckoo to successfully make it all the way back?*
  (Answer: Cuach KP)
- *Where in County Cork did this cuckoo make a quick stop just before reaching Killarney?*
  (Answer: Fermoy)
- *How many kilometers did Cuach KP travel on this massive round-trip journey?*
  (Answer: 9,000 kilometers)



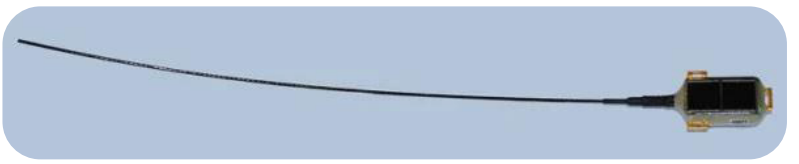
Introduction



Fun Fact!

In 2024 three Irish cuckoos were tagged in Killarney National Park to track their migration from Kerry and back again. Cuach KP, the first of the three to complete the journey, travelled 9,000 kilometres. The cuckoo made a quick stop in Fermoy in Cork before finding his way back to Killarney. Further detail in the RTE News video.

Explain to the class that in the 'Cuckoo Tracking Project', a piece of technology called a Satellite Tag was used to track their movements. Display the image of the Satellite Tag on the IWB.



Each Cuckoo had a tag placed around their leg, and this tag sends **location data** - approximately every day - so scientists can follow them and learn more about their migration.

Next, display the following map of Cuach KP's journey from Killarney to the Congo on the IWB. Alternatively, allow learners time to explore the interactive map on digital devices.





Introduction



Can learners find some of the locations mentioned in the RTE News video? *(Suggestions: Europe - The Alps; Italy; Spain; Bay of Biscay; Ireland (Fermoy; Killarney); Africa - Sahara Desert; Sudan; Congo Basin Rainforest; Africa/Asia - Egypt)*

Further information, and a live map of the journeys taken by cuckoos can be found on the **Cuckoo Tracking Project website**.

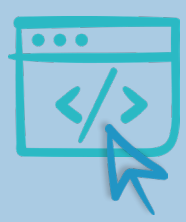
Explain to the class that this is very important work by scientists and gives us lots of interesting information about the cuckoos' journey and migration habits. **Technology** has really helped with this project. However, **scientists sometimes need our help too!**

The next part of the session explores what we mean by 'Citizen Science' and how anyone can get involved.

Development
[35 minutes]

Resource(s):

- **National Biodiversity Data Centre (NBDC) video**
- Citizen Science Projects: *(Find all links in Resource section)*





Citizen Science [15 minutes approx]

What is Citizen Science?

The clue is in the title! It's when regular people, including young learners, help scientists to do important research. For example:

- listening for the call of the cuckoo
- counting how many swifts are flying in/out of a swift box
- spotting plant species budding in early Spring
- counting and classifying the insects who live in the areas around our school grounds

We can all be citizen scientists! Let's find out how..

Introduce the National Biodiversity Data Centre (NBDC) with the following **video** (3 min, but from 0:00 - 1:02 is the most relevant).



Development



Explain that the **National Biodiversity Data Centre (NBDC)**, is a national organisation that collects and manages data on Ireland's wildlife. It is the central database for Ireland's wildlife records.

When a citizen spots a living thing (e.g., a butterfly, a mammal, or a unique plant), they can log it via the NBDC website or smartphone app with three critical pieces of data:

- *What was seen?*
- *Where was it seen (location/GPS)?*
- *When was it seen?*

Explain to the class that if anyone wants to build on a piece of land, they must first check these maps to see if a protected species lives there or if it is a protected habitat. A habitat or species is protected if it is a precious part of nature that will disappear if we don't look after it. If we don't have information on the area or the animal, we won't know how well (or how poorly) it is surviving. Data equals protection. It works in the following ways:

- ***Tracking Change:*** The NBDC uses data to document Ireland's wildlife resources and track how they change over time.
- ***The Power of Sightings:*** They store over 4 million species occurrence records for more than 16,000 Irish species.
- ***Citizen Science:*** The NBDC manages a Citizen Science Portal where anyone can submit sightings of birds, insects, or mammals to help build a scientific base for conservation.

For more information, and access to the full database of records, please visit:
https://records.biodiversityireland.ie/

The National Biodiversity Data Centre runs different projects that invite people to be citizen scientists. Briefly introduce learners to three current projects which demonstrate how scientists and citizens use digital tools (e.g., cameras, audio recorders, and sensors) to find patterns and understand living things across the island of Ireland.

Learners could be provided with a one-page version of this information to be discussed in small groups:
Session 9_CitizenScienceProjects



Development



1. The Irish Hedgehog Survey (NBDC / NUIG):
Citizens use trail cameras (motion-activated infrared sensors) in their gardens to capture nocturnal animal movements. This helps map hedgehog density and understand their nocturnal patterns without disturbing them.





More information here:

- https://www.irishhedgehogsurvey.com/home
- https://biodiversityireland.ie/surveys/irish-hedgehog-survey/

2. Explore Your Shore! (NBDC):
Focused on coastal marine biodiversity. Citizens use smartphone cameras and geo-location to record species like bivalves, crabs, and kelp. This tracks climate-driven shifts along the Irish coastline.



More information here:

- https://exploreyourshore.ie/home/
- Jump straight to their Seashore Spotter Citizen Science survey which allows you to record any marine species, any time, anywhere: https://exploreyourshore.ie/surveys/seashore-spotter/



Development





The Bat Conservation Ireland Waterways Survey: Citizens use ultrasonic bat detectors (audio sensors). Because bats hunt using echolocation at frequencies humans cannot hear, these sensors convert bat sounds into digital signatures, allowing volunteers to identify different bat species (like the Daubenton's bat) flying along Irish rivers.



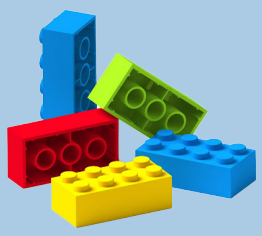




More information here:

- https://www.batconservationireland.org/what-we-do/monitoring-distribution-projects/ireland-daubentons-bat-waterways-survey
- https://maps.biodiversityireland.ie/Dataset/128/Survey/268 Citizen Science data gathered into a map used by biologists

Development
(Build)



Resource(s):

- Book 2 and Bag 8 from the Explore Set
- Long red piece from the Explore Set
- Smart Hub and motor from the LEGO Education SPIKE Essential set
- Digital Device
- Prototyping LEGO elements (Bags 9 - 13) from the Explore Set



Build and program the Research Device model [10 minutes approx]

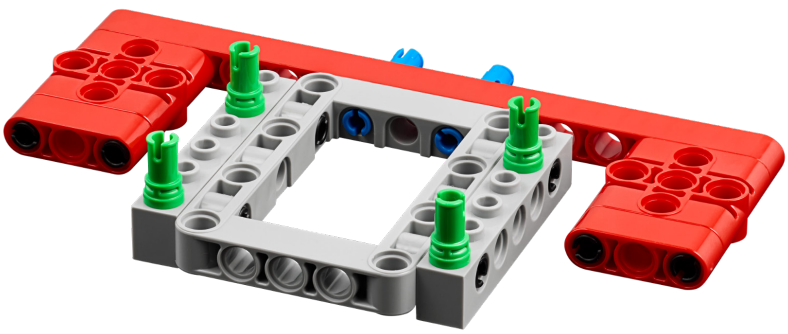
In our next LEGO build we have been tasked with building and programming a research device which could be used in a citizen science project just like the three we have learnt about. The goal is to build and then adapt the research device to help find patterns and understand living things across the island of Ireland.

Explain to the class that to achieve this, we will need to work like engineers and technologists to first build, and then program and improve research devices that could gather data about biodiversity in Ireland.

Purpose of the build:

- To enable learners to apply previously developed computational thinking skills in a new context (i.e., programming the sensor)
- Further explore how the sensor and sensor code blocks function in if-then algorithms
- Use empathy to plan, make, test and evaluate a design prototype to solve a problem

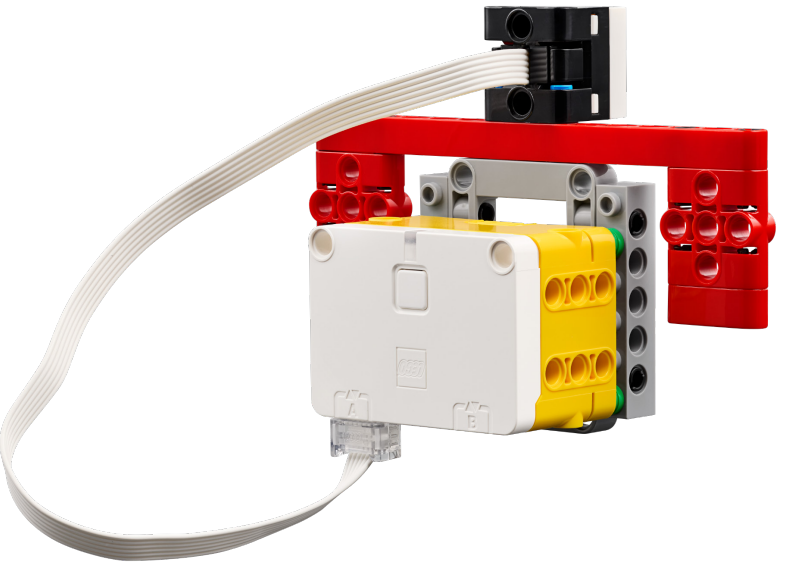
Divide the class into teams. Each team will need Book 2, Bag 8 and the long red piece from the Explore Set. Teams will also need the Smart Hub and sensor from the SPIKE Essential kit.



Instruct each team to build the research device model, this is a very straightforward build, and will take approximately 5 mins.

Development
(Build)

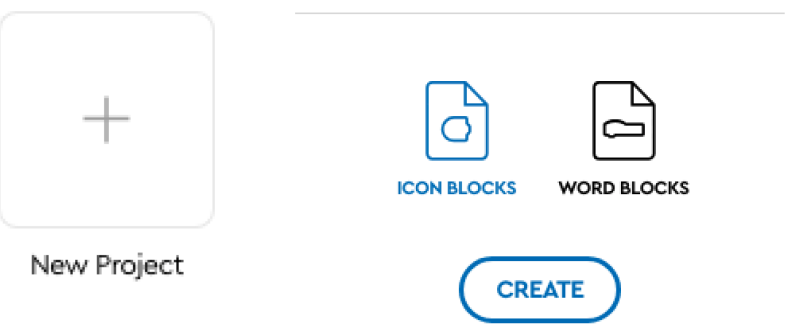




Once built, ask learners to think about:

- *What does the research device look like? (e.g., digital camera/security camera/motion sensor)*
- *Based upon the parts involved, what should it do? (e.g., the sensor will detect colours; red 'handles' suggest it might be held like a pair of binoculars)*
- *Based on this purpose, what blocks could we use to program this research device? (e.g., sensor block as the input, but what outputs? Play a sound; blink a light on the smart hub; display colours on the light matrix)*

Following this discussion, challenge the learners to program the research device. Teams will need a digital device to program their model using the SPIKE Essential app. As in the previous session, learners will open a new blank project to program their model. Direct them to name the project and select 'icon blocks'.

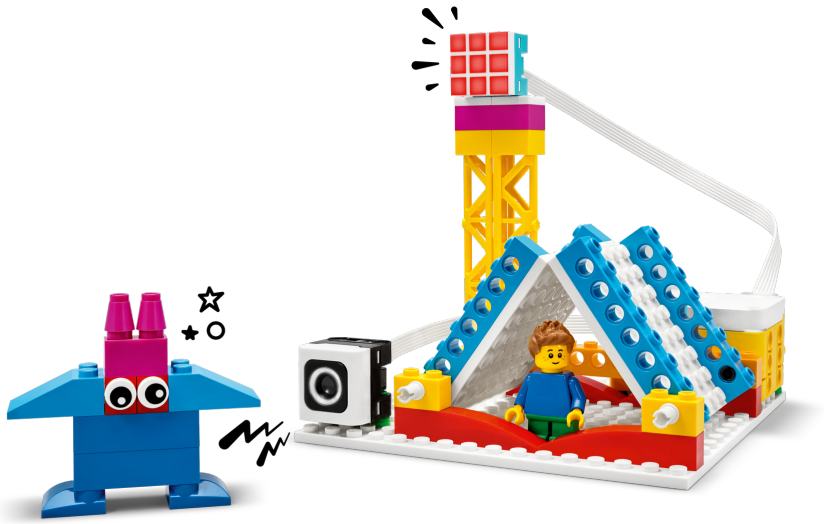




Development
(Build)



Learners can be prompted to think back to Session 6 where they programmed the Animal Alarm to play a sound when the sensor detected movement, or a specific colour.



How could they use what they already learnt about programming the sensor to 'react' to a stimulus (or an **input**)? What would happen after the sensor detects an input? Will this cause another action, like a sound to be played, or a series of colours to appear on the light matrix (i.e., if/then statements)? What might the sound or colours represent in their prototype?

As in previous sessions, it is important to emphasise to learners that this is not a case of trial and error; they are working like engineers here by making a change, testing it and then learning from this process. Encourage learners to document the program (code blocks) they are trying as they will be used again in later sessions.

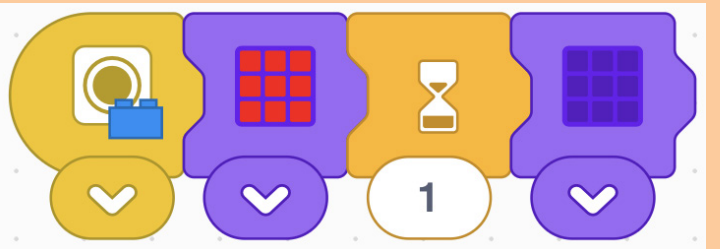


Development
(Build)





SPIKE Essential -
Research Device: If/Then statement



Once the colour sensor recognises the colour (blue), the colour light matrix will display a 3 x 3 grid of red lights. After 1 second has passed, the colour light matrix will not display any lights.

This can be changed based on: 1) the colour sensed, and 2) the colours displayed on the light matrix

Adapt the Research Device model
[10 minutes approx]

Instruct the class to think of their research device made from LEGO as a prototype for a real device that will be used by Citizen Scientists.

Note to Teachers:

Remind learners that even though their LEGO SPIKE sensor detects colours, when planning their prototype they can imagine it could detect other forms of data.

Challenge teams to first think of a way their research device could be used by real people to track changes in Ireland's natural heritage without human interference. Remind learners that data helps us know **where** species are and **how many** are left. Without sensors and citizen sightings, scientists wouldn't know which habitats need restoration or which species are in danger of extinction.

The following **key questions** can help scaffold learners in their planning:

- *What living thing are they interested in? (e.g., plant, fungi, mammal, bird, insect, etc.)*
- *What type of data are they gathering? (e.g., image, video, location, sound, etc)*
- *Will their device be mobile or in a fixed position?*

Development
(Build)



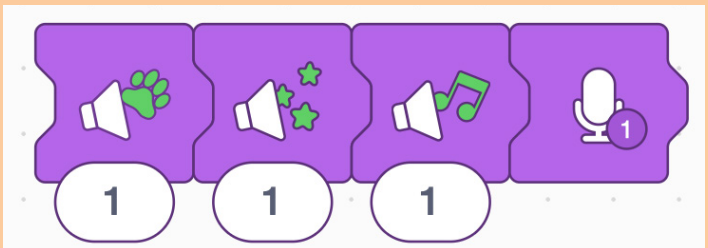
Allow teams time to agree on a plan for how they will adapt and program their research device. Rough sketches are encouraged, but some groups may prefer to make changes directly.

Prototyping LEGO elements (Bags 9 - 13) from the Explore Set can be used to improve their prototype research device.

Some groups may prefer to only change the program (i.e., code).

Remind groups that they will be presenting and explaining their research device and how it will be used.

SPIKE Essential - Sound Blocks





Closure (Document/ Share/Tidy up)



Resource(s):

- Digital Portfolio
- Digital Device

Document:

1. Each team documents and reflects upon their Research Device - adding photos, videos, notes to their digital portfolios.
2. Consider how they built it, how it works, how they might change or adapt or improve it.

Share:

1. How they improved the Research Device
   a. Physical changes and/or changes to the program
   b. How their research device could be used in a citizen science project
2. Show the coding skills they learned.
   a. Explain how they changed the program.
   b. Explain a problem they faced or overcame.
3. Demonstrate their solutions.

Teams tidy up:

The smart hub and sensor should be removed from the Research Device model and returned to the LEGO Education SPIKE Essential set. The Research Device model can be left assembled as it may be used as part of team projects later in BIOGLOW.



Extension Activities
[Consider These Ideas]







Consider these ideas for extension activities:

Literacy: The Long Flight.

Imagine the satellite-tagged cuckoo could actually talk to us about its incredible journey from Ireland to Africa and back. What would it say about the sights, the dangers, and the long days of flying? Let the cuckoo share its story using one of these options:

- Write a Travel Log: Keep a diary of your stops as you cross deserts, oceans, and rainforests.
- Send a Postcard: Write a quick message to a fellow species waiting for you back in Ireland.
- Record a Podcast / Voice Note: Record a short audio diary describing the toughest challenges you faced in the skies.

Science / Maths / STEM:

Select an ongoing National Biodiversity Data Centre (NBDC) initiative to join as a class.

Task learners with designing novel, collaborative methods to work as active Citizen Scientists. In small groups, learners could map out a data plan answering three core questions:

- **Observe:** How will they systematically monitor the school grounds or local habitat without disturbing wildlife? (e.g., setting up a timed daily bird-watch or a designated mini beast hotel).
- **Record:** What tools will they use to capture accurate observations? (e.g., creating a shared digital spreadsheet, drawing field sketches, or using digital cameras to log species).
- **Share:** How will they upload their findings to the official NBDC portal, and how will they showcase their discoveries to the rest of the school community?

Science / STEM:
Learn more about the Cuckoo Tracking Project by engaging with the following RTE resources:

Start by playing the short (3:26) excerpt/podcast from RTE Radio where technology has been used in the 'Cuckoo Tracking Project' will trace the routes of three cuckoos. These are Cuach Seán from the Wicklow Mountains National Park, Cuach Rua from the Burren National Park and Cuach Cores from Killarney National Park.

- **RTE Article with embedded podcast**
- **Podcast only**: (0:00 - 3:26).

Session 10: Team Model & Poster

Purpose:

Learners will work in teams to create their Team Model and Poster, which shares what they have learned about biodiversity, and demonstrates an understanding of the work of scientists and the technology used to study and protect nature.

Be advised that the time required for creating a Team Model & Poster will vary by class level and experience. This will take at least three hours of class time.

Core Values:



Learning outcomes:

Learners will be enabled to

Team Model:

1. Demonstrate knowledge and understanding of biodiversity and the work of scientists and the technology used to study and protect nature.
2. Work collaboratively to build and code a Team Model sharing what they have learned about biodiversity.
3. Collaboratively design and label the Team Model.

Team Poster:

1. Work collaboratively to plan and design a Team Poster which describes the team's learning throughout the sessions and supports the Team Model.
2. Communicate the purpose of the Team Model.

Learners will build:

- Each team will build a LEGO model of their own design which includes motorised parts and sensors (at least one).

Progress:

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Mathematics • Geography • Visual Arts • Language (English) • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 42 for full details of Subject, Strands, Strand Units and Skills	

Resources

Per team:

- Materials for planning design: digital tool (e.g. Book Creator/ Canva/Slides/PowerPoint, etc.) or paper/copy
- LEGO Education SPIKE Essential
- BIOGLOW Explore Set
- BIOGLOW Mat
- Prototyping pieces (from BIOGLOW Set)
- Digital Device
- Digital poster software (e.g. Canva, Slides, piktochart)
- Or Poster board
- Digital Portfolio which includes reflections, photos and videos of their building, coding and computational thinking to date
- Markers/crayons/colouring pencils

Optional:

- The Team Model can use extra LEGO bricks, minifigures, baseplates and other LEGO elements in addition to the LEGO Education Set and BIOGLOW Set.
- Additional multimedia resources can also be used to support their project (e.g. video, presentation, interactive materials).

Digital Resources:

- BIOGLOW_Team Build Checklist





Introduction

1. The teacher introduces the session by reflecting on the BIOGLOW project to date. Suggested guiding questions to scaffold this discussion include:
   a. *What have we learnt about nature and biodiversity?*
   b. *What have we learnt about the work of wildlife scientists and the scientific process of studying nature?*
   c. *What makes protecting biodiversity and understanding our ecosystems important for the future?*
   d. *Which of the ecosystems, habitats, or animal adaptations (like camouflage or hibernation) was your favourite, and can you explain why?*
   e. *What types of STEM jobs or careers relating to biodiversity did we learn about, such as a wildlife biologist, bioacoustician, or entomologist?*
   f. *Could you explain to your partner what that specific career involves? Which would you like to do most, and why?*
   g. *What types of tools and technology, such as sensors, canopy cameras, or Passive Acoustic Monitors (PAMs), did the scientists use that enabled their team to study and protect nature?*

2. Follow this by asking learners what they would share with others from the BIOGLOW sessions (e.g. other classes, parents, family, wider school community)?

3. Next ask the class to think about the LEGO builds and programmes (codes) they encountered.
   a. *What have they built?*
   b. *What types of coding blocks do they know how to use (e.g. motor, sensor)?*
   c. *What types of things could they programme their LEGO robot to do? (e.g. sound, colour, movement)*
   d. *Were there any ways they could programme their LEGO robot to react to motion (e.g. sensor)?*

4. Finally, explain to learners that they are now going to use all that they have learnt through the BIOGLOW sessions in order to create a Team Model and Poster "that shares what they have learned about biodiversity and demonstrates an understanding of the work of scientists and the technology used to study and protect nature."



Note to teacher:

The BIOGLOW™ theme is intentionally broad, allowing for learner agency in selecting a project topic or a specific problem they would like to solve. The following are some general ideas for projects to support teachers in guiding their teams:

- Representing an Irish ecosystem: Creating a motorised model of a local habitat (e.g., a native hedgerow, a peat bog, or a freshwater river) to show how native Irish flora and fauna, such as the Oak tree or the Common Frog, interact and support a healthy ecosystem.
- Exploring the layers of the rainforest: Representing life within a specific zone of the rainforest (e.g., the emergent layer or the forest floor) and the unique creatures adapted to live there by creating a motorised habitat that tells a story of interdependence.
- Representing a STEM career related to Biodiversity: Creating a motorised Team Model that demonstrates the daily tasks of a specific career, such as a Wildlife Biologist using trackers to study animal movement.
- Prototyping technology for discovery: Designing and coding a new tool or device to assist in environmental study, such as an automated water-testing tool to check river health, a GPS device to track forest growth, or a specialised sensor to monitor air and soil changes.
- Addressing a challenge to biodiversity: Identifying a threat to nature (e.g., habitat fragmentation, the spread of invasive species) and designing a Team Model that represents a creative way to address that problem.
- Representing a community-based solution: Creating a motorised model of a real-world project to support local nature, such as a "Living Classroom" in the school garden, a citizen science station for recording sightings for the National Biodiversity Data Centre, or designing a biodiversity-friendly corridor for wildlife in their local area.
- The 'top ten' lists prepared by the National Biodiversity Data Centre (NBDC) could help teams when considering what problem or story of biodiversity they wish to address with their team model and poster. These are linked at the end of this session.

Teacher Note:

These suggestions are designed to spark inspiration, not act as a restrictive 'project menu.' Teams are highly encouraged to investigate the natural world in their own school grounds or local communities to find a story that inspires them.

Development

Resource(s):

- LEGO Education set
- BIOGLOW set
- Additional LEGO pieces
- Digital device
- Digital portfolio (reflections, photos and videos of previous builds and code)
- A4 paper or relevant copybook for planning



The focus for the remainder of this session is on the creation of a Team Model & Poster. It is likely that teams will work at different paces and require different levels of support and scaffolding.

Some groups may need to complete their discussion or plan for their team model, others may be ready to begin iteratively building their team model.

Some teams may elect to focus on the Team Model first, followed by the Team Poster. Others may work on both simultaneously. There is no 'correct' approach or order.

Team Model:

In teams, learners build the design using the prototyping pieces and any other LEGO elements available. Learners ensure that their Team Model meets the Team Model requirements (below):

Team Model requirements:

1. Include motorised parts and sensors (at least one).
2. Use LEGO coding (SPIKE app).
3. Should fit on a table, be sturdy and be easily transportable to bring to a showcase festival.
4. There is no requirement to use the BIOGLOW Mat, or builds. If using the base models (like the BIOGLOW tree or lifting platform), it is encouraged that they be adapted.
5. Teams can use additional materials to support and represent different aspects of their build.





Development



Make Team Poster:

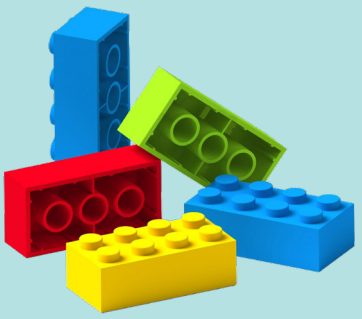
Alongside building their Team Model, teams are tasked with creating a Team Poster which supports their Team Model Team Posters should meet the requirements (below)

Team Poster requirements:

Your team poster should describe your team's journey throughout the sessions and support your Team Model. This can be physical (e.g., cardboard tri-fold, individual paper posters) or digital (e.g., Canva/Book Creator/PowerPoint). The poster should be divided into three sections:

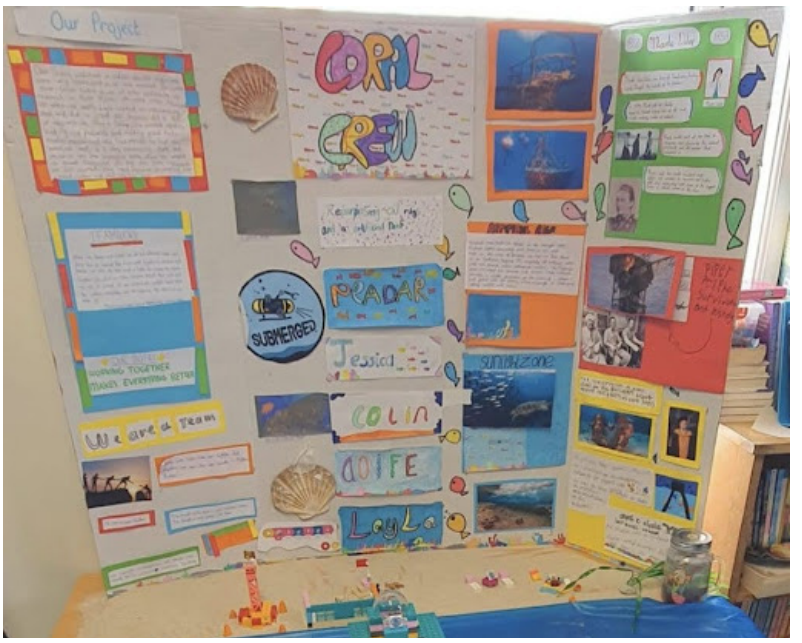
1. **Explore:** Focused on sharing your newfound knowledge of biodiversity, interdependence, and rainforest habitats.
2. **Create and test:** Focused on the design process of your team model, including the plants and/or creatures, the tool or technology used to study biodiversity, and how the team used LEGO coding to motorise their model.
3. **Share:** Focused on how the team worked together and what they want others to know about protecting biodiversity.

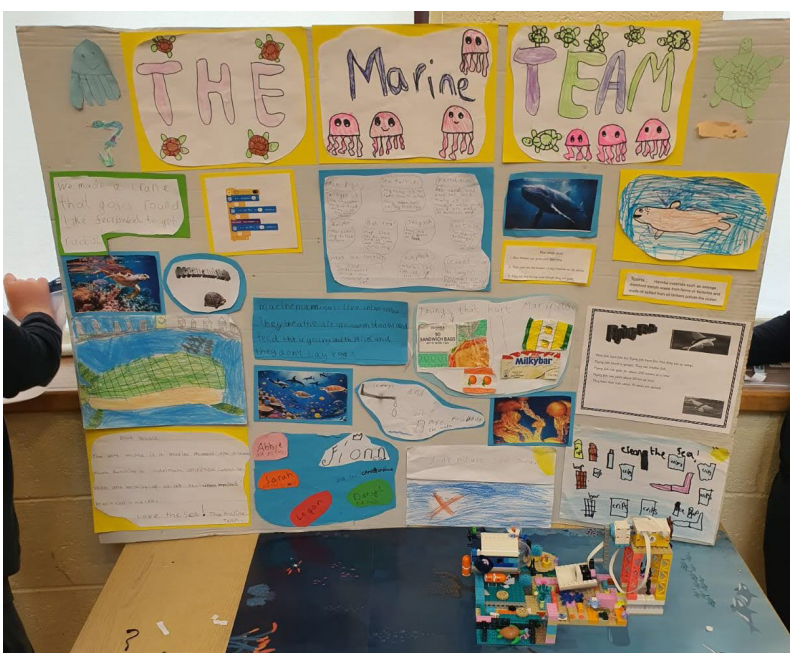
Development

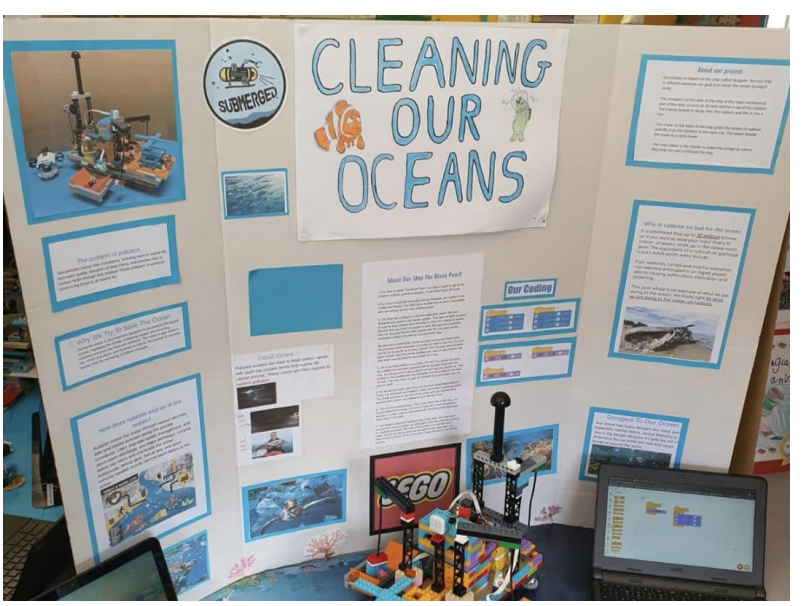




Examples of Team Posters from previous seasons:

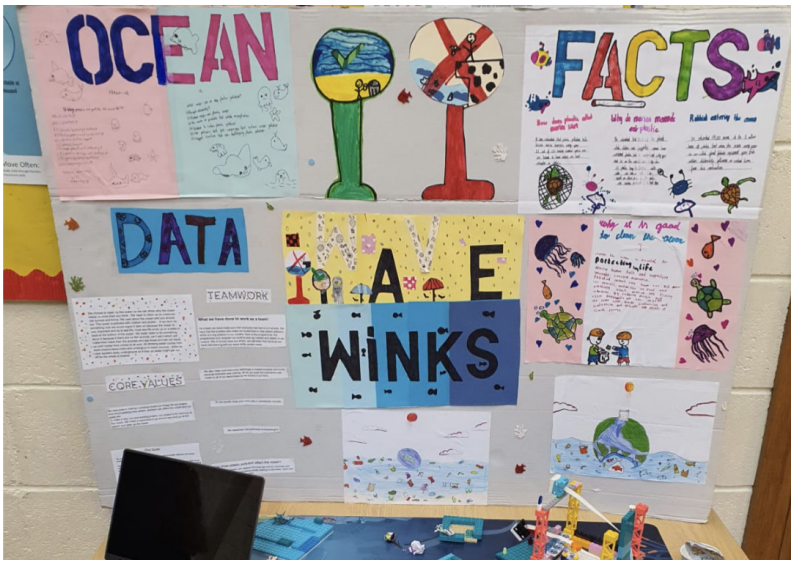


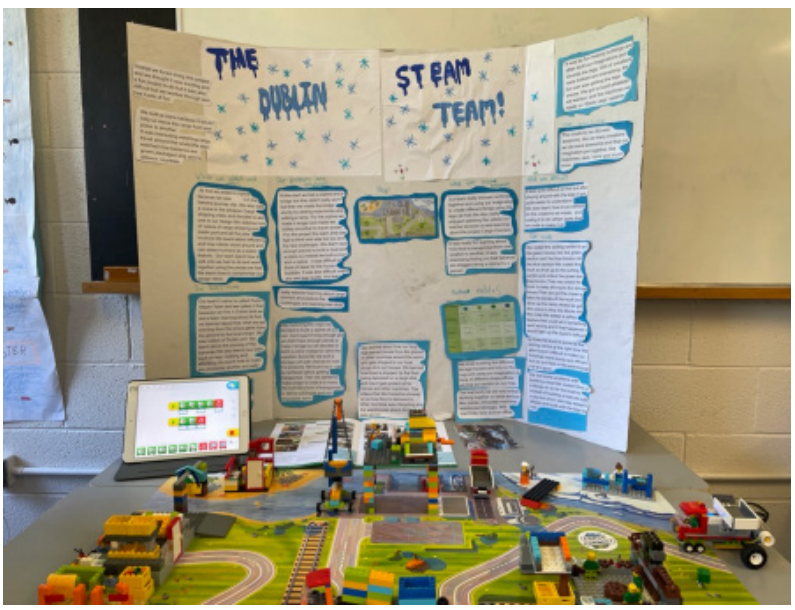


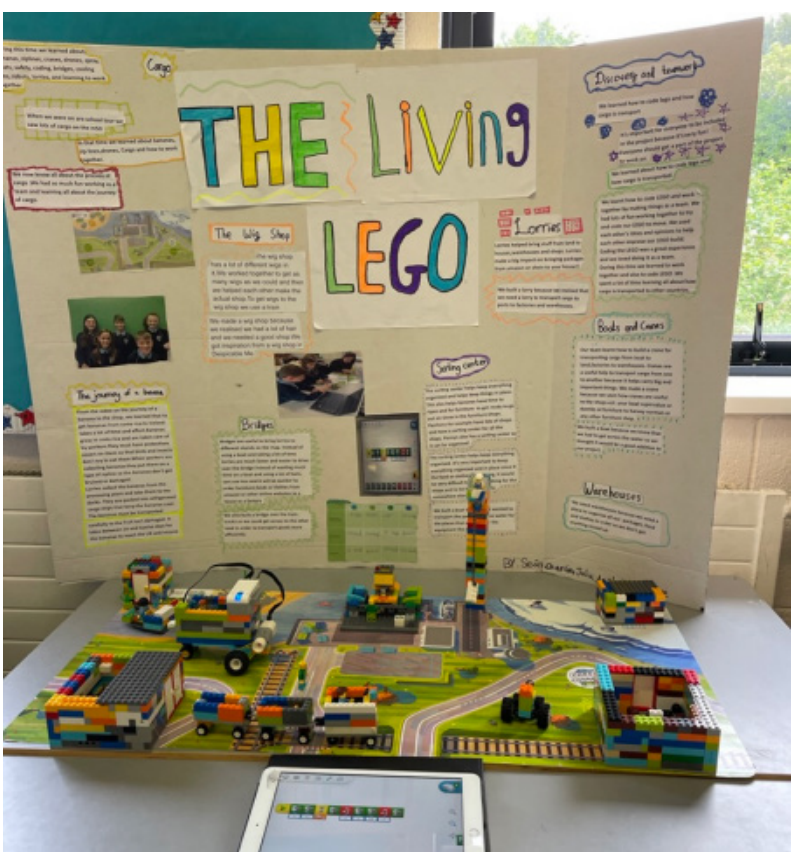


Development











Development



-- Suggested break between sessions --

Following completion of Team Models and Team Posters:

Evaluate: Encourage the learners to reflect on their build with their team: How does their Team Model share their team's knowledge of biodiversity, ecosystems, and the real-world technology scientists use to study and protect nature.

1. *What part of your model is motorised, and how have you coded this?*
2. *What sensors have you used, and how do they improve your model?*
3. *What other things would you like to add?*
4. *What are the strengths and the weaknesses of your design? (particularly structural - is the model sturdy enough to be moved)*
5. *What will your model teach, show or demonstrate about biodiversity, ecosystems, and the real-world technology scientists use to study and protect nature?*

The following **checklist of questions** can support assessment while teams share their models and run their code:

1. *Is power running continually?*
    a. *Does it start/stop - is there a pattern?*
2. *Is there a motorised part?*
    a. *What does it represent?*
    b. *Does it work as intended?*
3. *Are sensors used?*
    a. *For what purpose?*
    b. *Does it work as intended?*
4. *Does it make a sound?*
    a. *Is this sound linked to motion or as a safety feature?*
    b. *Could self-recorded sound be used?*
5. *Are there any flashing lights?*
    a. *What do these lights symbolise or represent?*
6. *Could ideas from other teams be adapted to improve your team's model?*



Closure (Document/ Share/Tidy up)



Resource(s):

- Digital portfolio
- Digital device
- Team build checklist

Document:

Each team documents and reflects upon their builds - adding to their digital portfolios etc.

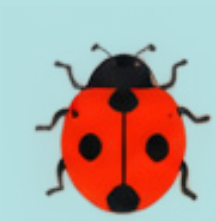
Share:

1. Teams share their completed Team Models and Posters with the class.
2. Teams demonstrate and explain how their team model and poster shares their team's knowledge of biodiversity, ecosystems, and the real-world technology scientists use to study and protect nature.
3. Teams explain the program and how sensors and motors are used as part of their build.

Teams tidy up:

1. The Team Model will remain assembled from this point forward until the event and should be placed in the designated storage space.
2. Any unused pieces should be returned to the correct box and stored - this includes LEGO Education set, prototyping pieces, and any LEGO elements supplied by learners.

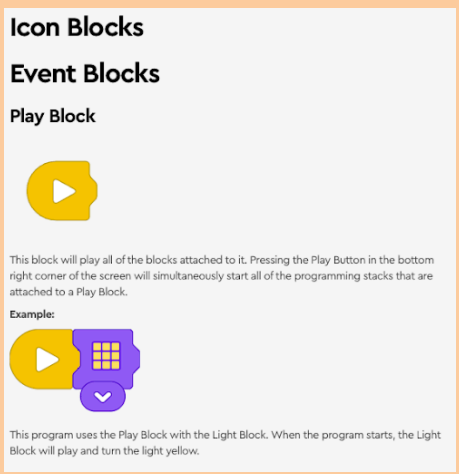
Coding & Build Guidance for Teachers



There is no specific code or build in this session.

The programs encountered to date should be adapted and innovated upon. Further assistance and guidance can be found below.

The SPIKE Essential app **help section** (bottom left corner of the app) includes a helpful detailed explanation for each of the Icon Blocks used to create code.



Coding & Build Guidance for Teachers



Teacher questioning and scaffolding will assist teams in creating innovative models. The more learners are questioned, the more they will be encouraged to think about the what/how/why of their prototypes/ models that represent their ideas. The following Guiding Questions could be adapted to support your class.

Guiding questions:

- *What part of your model could you motorise?*
- *What would you like it to do? How can you motorise it to do this?*
- *What sensors could you use? How might these sensors be used?*
- *Could we test and improve this?*
- *How does your model share your team's understanding of biodiversity, ecosystems, and the real-world technology scientists use to study and protect nature?*
- *I wonder if you could make use of skills you've encountered in other builds? Could your digital portfolio have ideas you could build on?*
- *Could your model make use of light and/or sound?*
- *Could you tinker with your code in order to make it work faster/slower?*
- *Could your model play an original sound? How could you record your own original sounds?*
- *I wonder if you could change the order of sound and light?*
- *Have you spoken to other teams to see how their model and code works?*
- *Could you learn from any of the other teams?*

Important Points to Note



As each class is unique, please decide upon the best way of grouping learners.

If learners are allowed to bring in LEGO elements, it is advised that either:

- Any LEGO elements contributed will become part of the class materials and not be returned.
- A clear record is kept of what a learner contributed so that it can be returned following completion of the project.

The teams will apply coding concepts throughout these sessions to create their programs.

As all teams will include learners of differing abilities, these sessions should be **differentiated** as required.

Extension Activities



Consider these ideas for extension activities:

The following 'top ten' lists prepared by the **National Biodiversity Data Centre (NBDC)** could help teams when considering what problem or story of biodiversity they wish to address with their team model and poster:

- 10 Conservation Success Stories
  Here we profile 10 conservation initiatives that have been very successful in delivery of conservation objectives. **https://biodiversityireland.ie/top10/10-conservation-success-stories/**
- 10 Ways to Help Biodiversity
  Nature responds quickly when land is managed in a way that is more favourable to biodiversity. Everyone who manages land can greatly improve the landscape for biodiversity, by making small changes. **https://biodiversityireland.ie/top10/10-ways-to-help-biodiversity/**
- 10 Species Ireland Has Lost
  Ireland's biological diversity is under pressure like never before. The ongoing programme of conservation assessments conclude that on average 20% of the species that have been assessed are considered to be at risk of extinction in Ireland. Extinction is not a new phenomenon as Ireland has already lost many species. Here is an account of 10 species that are already considered extinct in Ireland. **https://biodiversityireland.ie/top10/10-species-ireland-has-lost/**
- 10 Species at Risk of Losing
  Over 31,000 species have been documented for Ireland. Species diversity in Ireland is maintained because of the variety of habitats and environmental conditions available for plants and animals to live and reproduce. Here is a selection of just 10 of Ireland's most threatened species. **https://biodiversityireland.ie/top10/10-species-at-risk-of-losing/**
- 10 Most Unwanted Species
  Invasive non-native plant and animal species are the second greatest threat to biodiversity worldwide after habitat destruction. Ireland is no exception, and many species that have newly arrived to Ireland has disrupted local ecosystems and threaten our native biodiversity. **https://biodiversityireland.ie/top10/10-most-unwanted-species/**
- Aided by media captured during these sessions (images, video, etc.), learners write instructions on how to build their Team Model.
- In teams, learners record a short podcast based upon their experience creating their Team Model. The podcast can be created using an appropriate digital tool (Spotify for Podcasters, **Vocaroo**, etc). Suggested content: what part of their model is motorised, how a sensor is used, how these were coded, the individual input of each team member, etc.



Session 11: Let's share - Preparation for Showcase & Showcase Event

Purpose:

Learners will prepare to share their BIOGLOW project (including the poster and model) at a showcase event.

Core Values:



Final Showcase Event

The capstone to the *FIRST* LEGO League Explore project is a Final Showcase Event where teams can present their models and posters to other learners.

Schools and teachers may also opt for a Final Celebration Event within their own school where teams can present and share their projects and posters with members of the wider school community

However the class decides to share their projects and solutions, it is important that all learners get a chance to both present their work, and examine the work of other teams. This is to enable deeper reflection and learning.

Learning outcomes:

Learners will be enabled to

1. Communicate the purpose of their Team Model and Poster at a Final Celebration Event - learners share their knowledge of biodiversity, ecosystems, and the real-world technology scientists use to study and protect nature.
2. Discuss their knowledge and understanding of the BIOGLOW theme.

Progress:

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Mathematics • Geography • Visual Arts • Language (English) • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 43 for full details of Subject, Strands, Strand Units and Skills	

Resources

Per team:

- LEGO Build
- Digital Device (tablet, laptop)
- Poster (physical or digital, see Session 10 for details)

Digital resources:

- Lesson 11_ Showcase Peer Review Sheet BIOGLOW

Introduction



1. Explain the Final Celebration Event where the learners will showcase their LEGO builds and posters.
2. The key purpose of these events is for learners to share their projects and learn from others. There is an equal focus on sharing the what/why/how of their project, as there is on learning from the projects of others.



Development



1. Explain to learners that they will have three main jobs at the Showcase Event
   a. Share their Team Model and Team Poster, and be able to explain them.
   b. Answer peer review questions.
   c. Speak to other teams and learn about their models and posters.
2. Share the peer review prompts with learners and begin a discussion around what each question refers to, how might they be answered, etc.
   a. Allow time for teams to discuss potential answers to the peer review questions.
3. In teams, learners decide who will present each section of the poster.
   a. Learners review their Team Model and ensure that their code works. Learners decide who will present the Team Model.
   b. In teams, learners discuss what they have learnt throughout the BIOGLOW sessions. Learners should be prepared to share what they have learned at the Final Celebration Event.
   c. Pair teams up so that each team can practise their presentations with other learners.
   d. The sample reviewing sheet and reviewing questions can be used to support the learners during this session.

The prompts in the concept cartoon below could be used to further scaffold teams in their preparations.





Closure (Document/ Share/Tidy up)



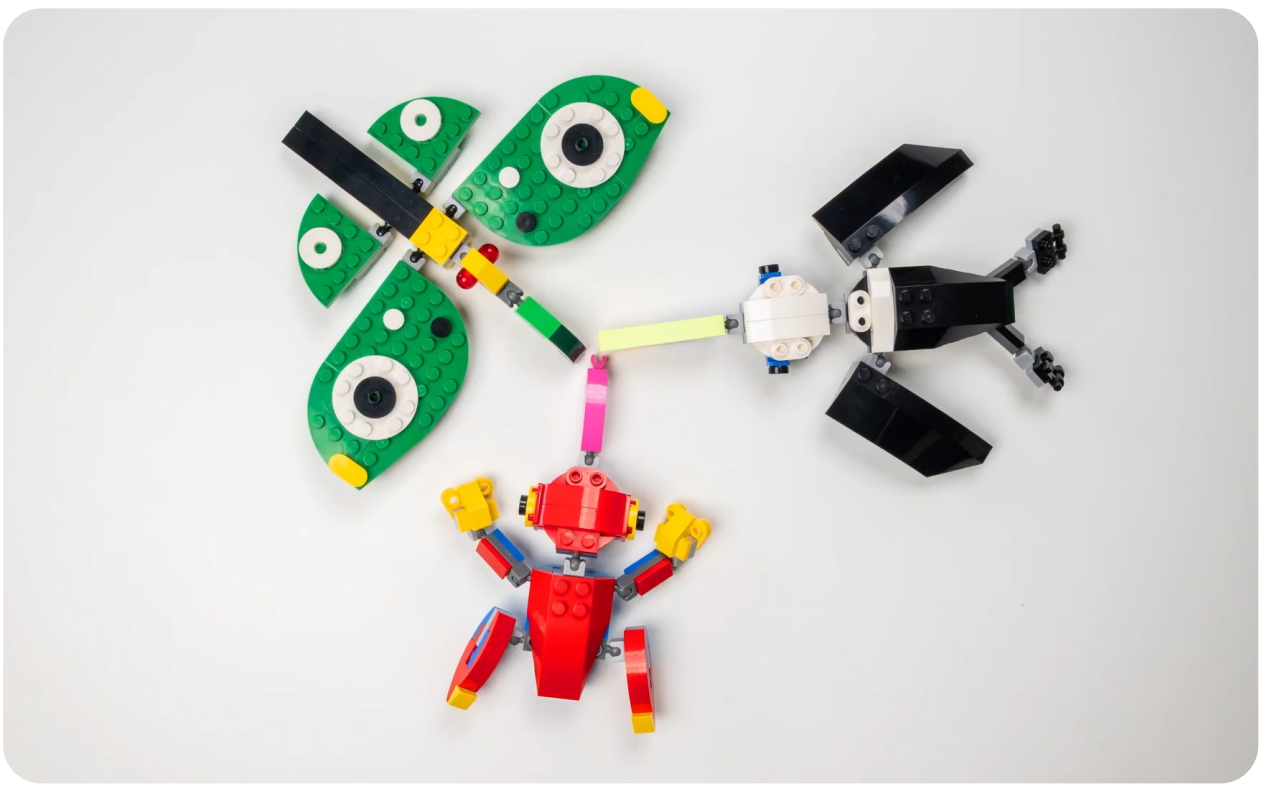
Share:

1. Reflection and assessment (self and peer) of presentations.

Teams tidy up:

1. Ensure Team Models and Team Posters are stored and ready to be transported to the event.
2. Ensure all devices are fully charged.





Session 12: Let's Reflect

Purpose:

Learners will reflect upon their Team Model and Poster, their understanding of biodiversity and ecosystems, and their appreciation for the work of scientists and the real-world technology use to study and protect nature.

Core Values:



Learning outcomes:

Learners will be enabled to

1. Describe their team's journey throughout the BIOGLOW sessions.
2. Discuss their knowledge and understanding of the BIOGLOW theme.

Progress:

1 2 3 4 5 6 7 8 9 10 11 12

Curriculum connections	
1999 Curriculum	**2025 Curriculum**
• Science • Mathematics • Geography • Visual Arts • Language (English) • SPHE	• STEM Education • Social and Environmental Education • Arts Education • Language • Wellbeing
See p. 44 for full details of Subject, Strands, Strand Units and Skills	

Resources

Per team:

- Team Model
- Digital device (tablet, laptop)
- Team Poster

Digital resources:

- Lesson 12_ Reflection Prompt Questions_BIOGLOW



Revisiting



Revisiting

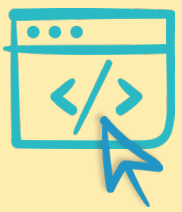
1. Ask the class to think about their recent Showcase Event. The following prompts could be completed as an oral discussion, think-pair-share, etc.
   a. *What did they enjoy most?*
   b. *Find the most challenging?*
   c. *Learn from other teams?*

2. Now that we have built Team Models, created Team Posters, and shared our passions at a Final Celebration Event, it is time to reflect on all that we have achieved and learned along the way.

Meta reflection

Resources:

- Digital devices
- Prompt questions to display on IWB



Individual/Group Activity



The following prompt questions should be considered by learners following engagement with BIOGLOW.

These might be discussed orally, in small groups or teams, or independently using a device/paper.

1. *What are three things you learnt about biodiversity and ecosystems?*
2. *How do scientists use technology to study and protect nature?*
3. *What is one thing that you learnt about yourself through completing the BIOGLOW project?*
4. *What part of BIOGLOW stands out for you? (Your favourite session, build, code?)*
5. *What have you learnt about coding and computational thinking?*
6. *What will you do differently now as a result of BIOGLOW?*
7. *What would you like to do with your LEGO Education set next?*
8. *What other real-life topics could we explore through the engineering design process?*

Following discussion, learners could be tasked with one of the following activities to further their reflection. The finished products could then be shared with the school community.

Record a short video diary of their experiences of BIOGLOW



Make an audio recording or podcast



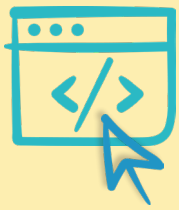
Write a short diary entry and type or photograph this for inclusion in their digital portfolio.



Audit equipment

Resources:

- **Audit sheets**



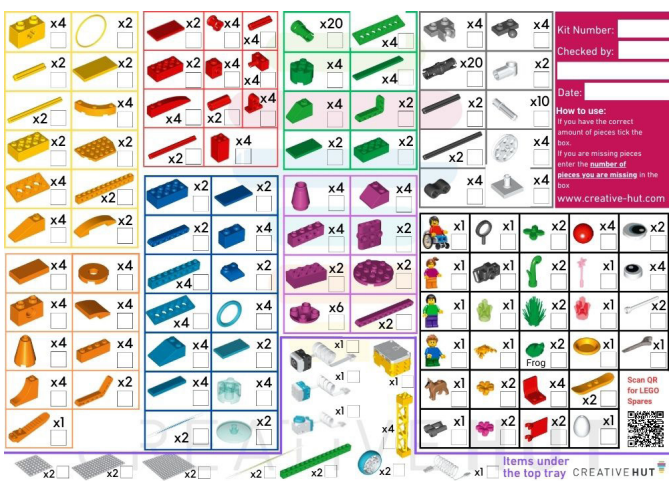


Any final photos or videos of the Team Model should be taken as the final part of this project is to disassemble and audit the LEGO Education equipment.



All LEGO Education equipment should be disassembled and returned to its correct place.

All elements from the SPIKE Essential boxes should be returned and audited using the audit sheet.
https://fll.ie/qr/spike-essential-stocktake



If any elements have been lost, replacements can be ordered from: **https://www.lego.com/en-ie/service/replacement-parts**

All LEGO elements from the BIOGLOW Explore Set should be disassembled and returned to suitable containers (e.g. ziplock bags) for use by a future class. It is highly advised that the Explore models (e.g. Rainforest tree) be disassembled into separate bags for future use.

Any LEGO elements belonging to learners can be disassembled and returned to them at this point.

References:

fll.ie/BIOGLOW

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