



The Institution of
Engineering and Technology



CHALLENGE

Teacher Guide for Ireland

Developed by TUS Technology Education Department

FIRST® LEGO® League Challenge

Presenting: SUBMERGEDSM



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Welcome to the **FIRST® LEGO® League Challenge** **SUBMERGEDSM** Teacher Guide for Ireland



Science Foundation Ireland

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Technological University of the Shannon Technology Education Department

This guide has been developed by a team from TUS Department of Technology Education to support schools, teachers, and outreach organisations to engage with *FIRST* LEGO League Challenge within their classrooms and extra-curricular programmes.

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IET

We're passionate about STEM (science, technology, engineering and maths) and inspiring children to follow their dreams, get creative and have fun whilst learning how the world around them works. Our programmes are for children aged 4 to 16 years and aim to bring their imaginations alive to inspire them to engineer a better world in the future.



CreativeHUT

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

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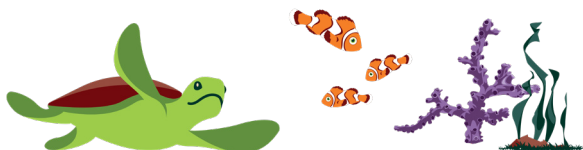
Welcome to the SUBMERGED Teacher Guide



This Teacher Guide for the SUBMERGED Challenge season aims to support Irish post-primary teachers and education leaders by demonstrating how *FIRST* LEGO League Challenge can be aligned with Junior Cycle and Transition Year Curricula. Through *FIRST* LEGO League Challenge post-primary learners can:

- Engage in hands-on authentic problem-solving experiences
- Be immersed in holistic integrated STEM learning experiences
- Be challenged to push the boundaries of how they think and engage with their world and those around them.

In this SUBMERGED season, learners are tasked with investigating how and why people explore oceans and exploring how the complex ocean ecosystem can support a healthy future for all below its surface. Teams must consider the challenges that are faced by those trying to explore oceans (of which 80% remain unexplored!) and develop ideas to overcome these. In tackling these real-world problems, learners develop a range of knowledge and skills through this immersive learning experience. Learners engage in an iterative design process and explore fundamental STEM principles through the building and coding of their robot powered by the LEGO Education SPIKE™ Prime or Mindstorms EV3 Set.





This SUBMERGED Teacher Guide is organised in three parts to support teachers in introducing and incorporating *FIRST LEGO League Challenge* in post-primary school settings;

Part A unpacks the structure of the competition and how SUBMERGED links to curriculum and policy including the STEM implementation strategies.

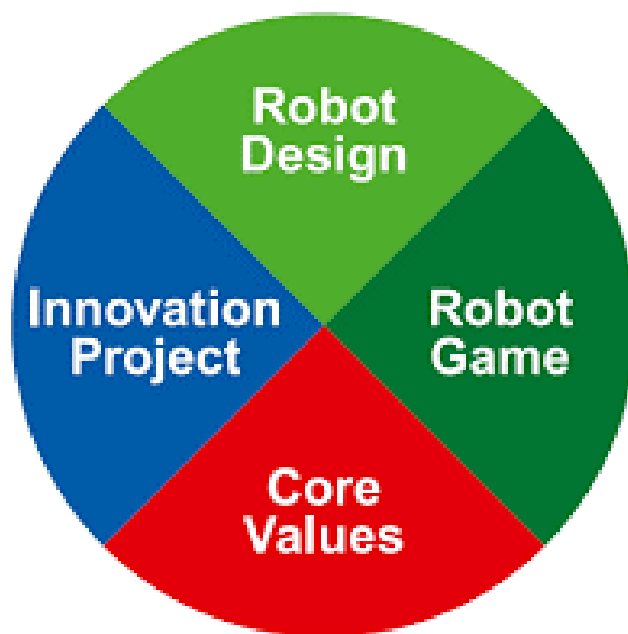
Part B provides an overview of how SUBMERGED can be introduced to learners including a suite of introductory challenges to familiarise teams with the

LEGO Education SPIKE Prime set. This section also sets out sample Learning Outcomes for Lesson Planning which supplement the *FIRST LEGO League Challenge Team Meeting Guide* and *Engineering Notebook*.

Part C details the role of the teacher and various ways SUBMERGED can be implemented in your school i.e. in class, lunch clubs, transition programme etc. At the end of this section there are several tips and tricks for delivering the programme in your school.



What is *FIRST* LEGO League Challenge SUBMERGED



FIRST LEGO League Challenge is a competitive and hands-on programme aimed at young people between the ages of 11 and 16 (6th class-Transition Year). The competition structure includes Regionals, Nationals, and Internationals.

The programme is premised on a Discovery Learning approach whereby an emphasis is placed on learners assuming responsibility for their own learning experience. The programme encourages students to explore, experiment, test, and iterate all while working as part of a team to solve and present their solution to a real-world problem. This promotes the holistic development of learners with the focus not only being placed on developing technical STEM knowledge but also on acquiring key transversal skills such as communication, collaboration, and critical thinking.

Each year the *FIRST* LEGO League Challenge focuses on authentic, real-world scenarios where teams of up to 10 people (these teams can be made of learners from various class groups) work to solve a thematic challenge. There are four aspects to the challenge each worth 25% of a team's score in the competition; an Innovation Project, Robot Design, Robot Game, and Core Values.

This year's Challenge is called SUBMERGED. The Innovation Project for this season focuses on the ocean ecosystem and problems faced by those trying to explore our underwater world. Teams will also iteratively design a robot (make sure to capture this process!) to compete in the Robot Game with missions which are based on the SUBMERGED theme. Refer to your Robot Game Rulebook for further details of these missions including mission scoring.

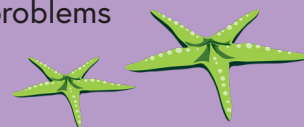
This SUBMERGED Teacher Guide has been designed to meaningfully connect this season's challenge to the Irish post-primary curriculum. There are 12 sessions associated with this season outlined in the Team Meeting Guide (TMG) and Engineering Notebook (EN). These are intentionally designed to support learners to autonomously engage in the *FIRST* LEGO League Challenge ensuring that an emphasis is placed on each of the four aspects of the competition. The six *FIRST* Core Values of Discovery, Innovation, Impact, Inclusion, Teamwork and Fun should be cornerstones of each of the 12 sessions that learners engage with.



Global citizenship and *FIRST* LEGO League Challenge

The SUBMERGED Challenge has many links to global citizenship. global citizenship education aims to increase understanding of our impact on the rapidly changing, unequal, and interdependent world in which we live. Through the *FIRST* Core Values: Discovery, Innovation, Impact, Inclusion, Teamwork and Fun students will critically explore the impacts of current and future discoveries beneath the ocean's surface. This season's Challenge is to dive into a problem faced by people who explore the oceans.

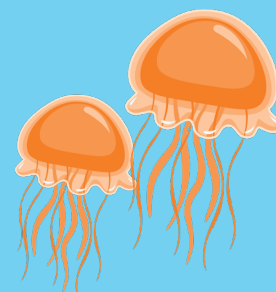
There is a host of examples to explore (see 'Project Sparks'), which will shine light on the complex relationship between our life on land and those under the sea. Teams' ability to encompass the *FIRST* Core Values within the innovation project will illustrate their commitment to global citizenship. They will discover the diverse marine life, ecosystems and humans' effect on life undersea, using these challenges to create solutions to these complex problems within our world.



Part A

Throughout this section of the SUBMERGED Teacher Guide an overview is provided of the Policy and Curriculum connections with this year's *FIRST LEGO League* Challenge season. Initially, general policy and curriculum agendas are presented with the following sections providing a more focused perspective on Junior Cycle and Transition Year programme connections.

The intention of this section is to support post-primary teachers in integrating the SUBMERGED season into their term planning in instances where the *FIRST LEGO League* Challenge will be integrated in an in-class manner. Where the **Challenge** will be offered as a lunch or after-school club, Parts B and C will provide support for mentors/supervisors of these clubs.

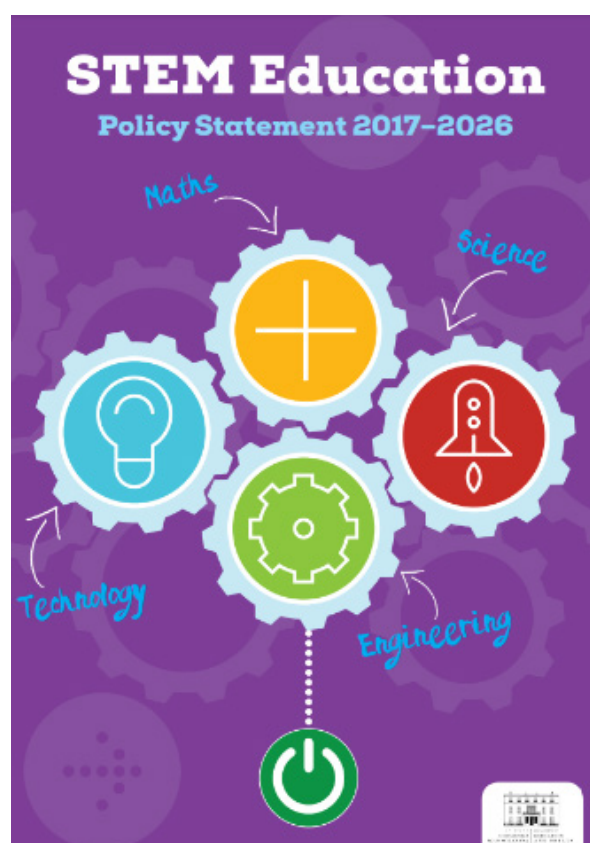


General policy connections

STEM education policy statement 2017-2026

FIRST LEGO League Challenge has a strong connection with the STEM Education Policy Statement including:

- A focus on increasing participation and interest in STEM through new interesting, fun and exciting ways.
- *FIRST LEGO League* Challenge is adaptable and suitable for various levels of ability increasing opportunity and access to holistic STEM education experiences for all.
- The holistic nature of the competition focuses on providing learners with opportunities to engage in deep, integrated STEM learning experiences enabling them to be resourceful and develop confidence in engaging in STEM concepts in school and the world around them.



STEM education implementation plan to 2026

FIRST LEGO League Challenge also has strong ties with the STEM Education Implementation Plan specifically, Phase 3 of Realising STEM in the curriculum. Some links include:

- Nurturing learner engagement and participation in STEM.
- Learners engaging in immersive, authentic, and integrated STEM experiences to replicate real-world experiences.
- Connecting with experts in the area to contribute to a deeper level of understanding of the role of STEM in the world around them.



Junior Cycle policy and curriculum connections



There are various connections between the Junior Cycle curriculum and *FIRST* LEGO League Challenge both in the foundational principles of the Junior Cycle Framework and at a subject specific level. Initially, this section outlines the connections between **Challenge** and the eight principles underpinning the Junior Cycle Framework, alignment with the Junior Cycle Key Skills and Statements of Learning. An overview is provided of subject specific connections providing an insight to subject areas

where SUBMERGED may be integrated. It is important to note that this is not an exhaustive list of curricular links, rather, the aim of this section is to provide an overview of potential opportunities for schools and teachers to integrate SUBMERGED into existing subject areas.



Connections to principles underpinning Junior Cycle framework



Learning to learn

FIRST LEGO League Challenge places learners at the centre of their own experience where they assume autonomy for their learning, facilitated by their teacher. Throughout the SUBMERGED season, learners are guided on a learning journey through the Engineering Notebook to critically consider different ways of thinking and doing, consolidate their own learning and communicate it to others. In addition, learners focus on meeting real challenges that impact life beyond school.

Choice and flexibility

The SUBMERGED Challenge offers variety of choice and flexibility of learning experiences and opportunities where learners can engage with an Innovation Project, Robot Game, or Robot build - or all three! It empowers teams to learn about new exciting concepts in a flexible environment to meet the needs of all learners.

Quality

Challenge is a competition which encompasses four key elements with an emphasis placed on teams having a high quality immersive and integrated learning experience. The pursuit of excellence in mastery of knowledge and skill is encouraged through the competition aspect of Challenge.

Creativity and innovation

Creativity and innovation are at the core of Challenge. Learners are encouraged to push the boundaries of their knowledge by gaining new experiences and by experimenting with their ideas. Robot Design, developing the Innovation Projects and competing in the Robot Game provide the opportunity to express their creativity and innovation, while always demonstrating the Core Values.





Engagement and participation

At the heart of *FIRST LEGO League* Challenge is engagement and participation. Teams are encouraged to actively participate in learning considering life beyond school and address real-world issues using fun and exciting technologies. Engagement and participation are further encouraged through living the Core Values.

Continuity and development

Teams are encouraged to build on existing knowledge, skills and values they have acquired to date and throughout the course of the competition. Through sharing and reflecting tasks in sessions teams document their progress and considering how these learnings can support them in moving forward towards achieving their competition goals.



Inclusive education

Inclusion is one of the six Core Values of *FIRST LEGO League* where teams are required to demonstrate how they respect each other and embrace their differences throughout their Challenge journey. Most importantly, the various elements of the competition offer authentic STEM learning and participation opportunities for all to contribute to the development of team solutions.

Wellbeing

The holistic nature of the Challenge competition shines a light on the wellbeing of the learner where they focus on their own wellbeing within the learning environment, wellbeing of others, and critically reflect on the wellbeing of the wider world around them.



Connections to Junior Cycle key skills

Samples of connections with <i>FIRST</i> LEGO League Challenge and SUBMERGED					
Junior Cycle key skills					
Being literate	Engagement with STEM terminology and disciplinary language to enable efficient and effective task specific communication.	Writing for multiple purposes to include communication of both conceptual and technical information.	Expressing ideas clearly and accurately through spoken, symbolic, and textual forms to varying audiences.	Creating multi-modal outputs to capture and communicate their Challenge journey.	
Managing myself	Knowing myself – Experience working with others and on a multi-dimensional task to surface personal skills, knowledge, interests and motivations.	Student monitors and critically evaluates aspects of their work throughout and after the task that leads to them setting and justifying new or alternative goals, targets or strategies.	Student identifies, analyses and evaluates key issues in their work as it evolves and makes considered decisions on how to address them.	Use digital technologies to support planning, thinking, communication, and presentation of personal development and solution.	
Staying well	Student as part of a team will experience a sense of belonging and provide a voice for all, giving each student the capacity to form and express views.	<i>FIRST</i> LEGO League Challenge provides the space to have meaningful input to a student-lead activity and experience success at multiple levels.	Students build confidence through skill development and having their contribution valued. Where student can see how they can influence their future.	Students will build positive relationships with peers, teammates, partners, other teams, teachers, and organisers and see the importance of the core values.	
Managing information and thinking	Student demonstrates the conceptual understanding of key STEM concepts and principles and demonstrates an awareness of the need for research and analysis to inform their work.	Students justify why research and working with others was required in the task(s) and demonstrates how the analysis and interpretation of the data/findings supported effective decision making.	Student selects (or designs) a research method to generate appropriate data/findings in relation to their work, linked to broader issues in the local or global context such as climate action and sustainability.	Student presents analyses of relevant key STEM concepts and principles and shows their application in the context of the Challenge .	

Table 1a. Overview of sample connections between the *SUBMERGED* Challenge and key skills to be embedded in the curriculum.

Samples of connections with FIRST LEGO League Challenge and SUBMERGED					
Junior Cycle key skills					
Being numerate	Explore basic mathematical capability and literacy in the context of specifics goals. Understand arithmetical functions as they apply to application case.	Experience the use of measurement and units to compute and transpose information and measures across time, distance, rotation, etc. to achieve required function.	Explore geometry to include spatial awareness and relations as a function of mathematical sense and operations.	Explore the predictive power of probability and statistics to support speculative enquiry and enable an iterative exploration of key concepts and principles and the enable functional goals.	
Being creative	Students iteratively generate, compare, refine, collaborate, and implement their own ideas in relation to the task that leads to alternative approaches or solutions.	Students track the development and application of a unique or unconventional idea(s) showing how they achieved a goal or solution.	Students show where they tried things out or experimented to generate multiple ideas that they evaluated and refined to achieve a goal or solution.	Students demonstrate a curiosity that leads to new and/or unconventional ideas, which are refined and implemented through a cyclical/iterative approach to satisfy their goal.	
Working with others	Students working as part of a team to develop solutions to the innovation and robot game challenges and managing conflicts to reach team resolutions.	Co-operating and collaborating as part of a team to work towards and achieve agreed goals	Students collaborating with others to address a real-world problem to contribute to the broader world around them.	Working with others to acquire and consolidate new information through shared digital platforms.	
Communicating	Actively listening and expressing oneself in a group environment.	Discussing and debating various solutions to a problem. Experiencing varying ideas and perspectives	Using digital technologies to communicate Innovation Project and Robot Design to others.	Performing and presenting ideas to a panel of judges.	

Table 1b. Overview of sample connections between the **SUBMERGED** challenge and key skills to be embedded in the curriculum.

	The Student	Core Values	Innovation Project	Robot Design	Robot Game
1	Communicates effectively using a variety of means in a range of contexts in L1	•	•	•	•
3	Creates, appreciates and critically interprets a wide range of texts		•	•	•
4	Creates and presents artistic works and appreciates the process and skills involved	•	•	•	
5	Has an awareness of personal values and an understanding of the process of moral decision making	•	•		•
6	Appreciates and respects how diverse values, beliefs and traditions have contributed to the communities and culture in which she/he lives	•	•		
7	Values what it means to be an active citizen, with rights and responsibilities in local and wider contexts	•	•		
8	Values local, national and international heritage, understands the importance of the relationship between past and current events and the forces that drive change		•		
9	Understands the origins and impacts of social, economic and environmental aspects of the world around her/him		•		•
10	Has the awareness, knowledge, skills, values and motivation to live sustainably	•	•		•
11	Takes action to safeguard and promote her/his wellbeing and that of others	•	•		•
15	Recognises the potential uses of mathematical knowledge, skills and understanding in all areas of learning			•	•
16	Describes, illustrates, interprets, predicts and explains patterns and relationships	•	•	•	•
17	Devises and evaluates strategies for investigating and solving problems using mathematical knowledge, reasoning and skills	•	•	•	•
18	Observes and evaluates empirical events and processes and draws valid deductions and conclusions		•	•	•
19	Values the role and contribution of science and technology to society, and their personal, social and global importance	•	•		
20	Uses appropriate technologies in meeting a design challenge		•	•	•
21	Applies practical skills as she/he develops models and products using a variety of materials and technologies		•	•	•
22	Takes initiative, is innovative and develops entrepreneurial skills	•	•	•	•
23	Brings an idea from conception to realisation		•	•	•
24	Uses technology and digital media tools to learn, communicate, work and think collaboratively and creatively in a responsible and ethical matter	•	•	•	•

Table 2. Overview of sample connections between the SUBMERGED Challenge and Junior Cycle Statements of Learning.



FIRST LEGO League Challenge emphasises the development of life skills and future workplace skills through participants solving real-world challenges using research, coding and design. This significantly aligns with the mission of Transition Year (TY) in promoting personal, social, vocational and educational development of learners. Through taking responsibility for their own journey through the Challenge competition, with the teacher acting only as a facilitator, learners assume a greater level of autonomy. With the SUBMERGED theme students consider how they can be active and responsible members of society and respond to important challenges.

As the TY programme structure is designed by individual schools, within the set guidelines, there is a unique opportunity at this level of formal education for students to engage with the SUBMERGED Challenge. This challenge offers an opportunity for a truly integrated STEM learning experience which is not bound by specified subject class times. The session schedules for engagement

with SUBMERGED may be adapted to suit a Micro Module or Transition Unit to align with school needs.

Initially, this section outlines the connections between Challenge, curriculum principles underpinning Transition Year programmes and alignment with the Transition Year key skills.

An overview is provided of subject specific connections providing an insight to how SUBMERGED aligns with the formal subjects and Senior Cycle subjects. It is important to note that again, this is not an exhaustive list of curricular links, rather, the aim of this section is to provide an overview of how SUBMERGED aligns with existing subject boundaries.



Connections to curriculum principles

Content

Through engagement with *FIRST LEGO League Challenge* learners engage with integrated STEM and other disciplinary content aligning with Leaving Certificate material. Through the programme, teams have the opportunity for unique immersive learning experiences that challenge them to critically reflect on what they know, how they learn, and how they can advance their knowledge and skills to address real-world issues. This lays solid foundations for Leaving Certificate studies not only in terms of discipline content but also in the holistic development of the student in learning how to learn, managing themselves, seeking and researching relevant information and acquiring important life skills. Through Challenge an emphasis can be placed on developing learners' personal and social awareness and responsibilities.

Remediation and compensatory Studies

The integrated nature of Challenge affords opportunities for pupils to consolidate their learning to date and improve in various areas where they might be experiencing weaknesses e.g., subject knowledge, learning skills, confidence in their ability etc. Self-directed and open learning opportunities and experiences are embedded throughout *FIRST LEGO League Challenge*. The fun-focused nature and broad subject related scope of Challenge can contribute to pupils being better placed to consider their future study options for Leaving Certificate or other programmes.

Interdisciplinary work

Interdisciplinarity is at the core of the *SUBMERGED Challenge* season. Teams are required to apply STEM principles in an integrated manner and further consider geographic and global citizenship perspectives in creating their solutions to this seasons Innovation Project, Robot Game, and Robot Design. Challenge offers a unique opportunity for learners to engage in a unified learning experience which is not bound by the traditional compartmentalisation of individual subjects with the Transition Year programme having the flexibility to adapt to this type of experience.

Teaching methods and approaches

A key feature of Transition Year programmes is to use a wide range of teaching and learning methodologies and situations. Challenge requires learners to assume personal responsibility for their learning and enacts an activity-based approach. Teams are required to engage in group work, project work, and research, and connect with experts which may include visiting speakers or field trips throughout their Challenge journey. Teams can communicate their Innovation Project, Robot Design and Core Values through almost any medium including role plays, movies, displays, or presentations.



Connections to Transition Year key skills

Samples of connections with FIRSTLEGO League Challenge and SUBMERGED	
Information processing	<p>Student demonstrates conceptual understanding of key STEM concepts and principles and demonstrates an awareness of the need for critical reflection, research and analysis to inform their work.</p> <p>Student actively listens and expresses themselves and their opinions in a group environment.</p> <p>Knowing myself – Experience working with others and on a multi-dimensional task to surface personal skills, knowledge, interests and motivations</p> <p>Student learns to work effectively as part of a team to achieve collective and personal goals.</p> <p>Students iteratively generate, compare, refine, collaborate, and implement their own ideas in relation to the task that leads to alternative approaches or solutions.</p>
Communicating	<p>Student justifies why research and working with others was required in the task(s) and demonstrates how the analysis and interpretation of the data/findings supported effective decision making.</p> <p>Student works collaboratively within a group to effectively reach a solution to a real-world challenge.</p> <p>Student monitors and critically evaluates aspects of their work throughout and after the task that leads to them setting and justifying new or alternative goals, targets or strategies.</p> <p>Student cooperates and collaborates as part of a team to work towards and achieve agreed goals gaining an appreciation of social skills and group dynamics.</p> <p>Students track the development and application of a unique or unconventional idea(s) showing how they achieved a goal or solution.</p>
Being personally effective	<p>Student identifies, analyses and evaluates key issues in their work as it evolves and makes considered decisions on how to address them.</p>
Working with others	<p>Student collaborates with others to address a real-world problem to contribute to the broader world around them considering their role as a global citizen.</p>
Critical and creative thinking	<p>Student selects (or designs) a research method to generate appropriate data/findings in relation to their work, linked to broader issues in the local or global context such as climate action and sustainability.</p> <p>Student uses digital technologies and various media to communicate Innovation Project and Robot Design to others through oral presentations.</p> <p>Student identifies, analyses and evaluates key issues in their work as it evolves and makes considered decisions on how to address them.</p> <p>Student collaborates with others to address a real-world problem to contribute to the broader world around them considering their role as a global citizen.</p> <p>Students show where they tried things out or experimented to generate multiple ideas that they evaluated and refined to achieve a goal or solution.</p>
	<p>Student presents analyses of relevant key STEM concepts and principles and shows their application in the context of the Challenge.</p> <p>Student analyses written and visual forms and consolidates learning through written and visual mediums.</p> <p>Use digital technologies to support planning, thinking, communication, and presentation of personal development and solution.</p> <p>Student works with others to acquire and consolidate new information through shared digital platforms.</p> <p>Students demonstrate a curiosity that leads to new unconventional ideas, which are refined and implemented through a cyclical/iterative approach to satisfy their goal.</p>

Table 3. Overview of sample connections between the SUBMERGED Challenge and Transition Year key skills to be embedded in the curriculum.

Subject connections in post primary education

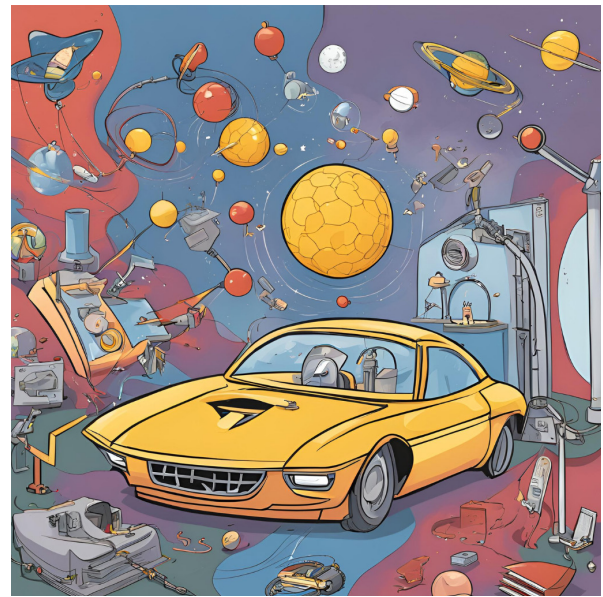
While this section addresses the curricular connections for the STEM subjects, *FIRST* LEGO League Challenge is an integrated approach to STEM education.

The following section will highlight the links and connections that are associated with a fully integrated STEM experience, where the scientific knowledge and method are intertwined with mathematical reasoning, prediction, and proof in support of designing and making tangible artefacts that achieve specific functions. Further subject connections are outlined relative to the SUBMERGED season where an emphasis should also be placed on integrated interdisciplinary experiences.



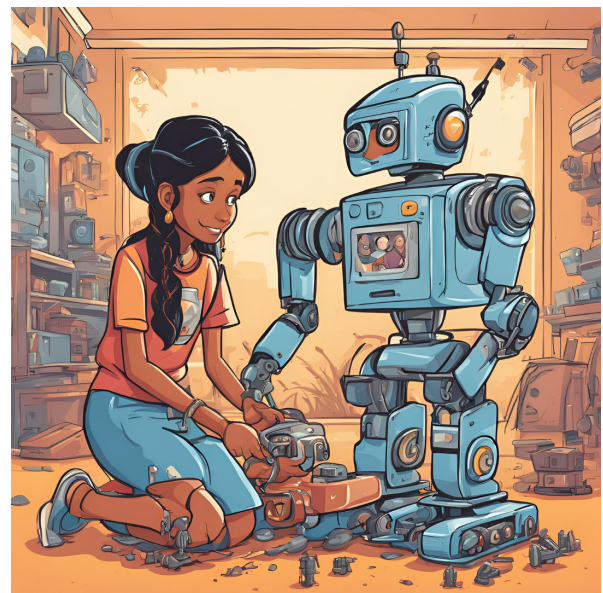
Science

Understanding the physical world and in particular matter, motion, energy, and force are central to enabling considered decision-making in response to the SUBMERGED Challenge. Fundamental Physics principles of forces and energy conversion are explored in the context of the effectiveness of a physical artefact as it executes specific tasks. This allows student to self-regulate decisions in response to observed effects and modify through in-context reasoning. The observation of cause-and-effect enables an iterative approach to the decision-making throughout the challenge.



Technology

The treatment of design in Technology uses an iterative approach to what can be described as a speculative-critical balancing of intentions, where ideas are considered in response to desirability, feasibility, viability, and sustainability with an approach that supports 'confronting' ideas with reality. This externalisation of thinking requires an understanding of not only the physical world, or mathematical probability but also use of systems knowledge. Use of electro and electro-mechanical systems to execute specific tasks creates testable theories and ideas.



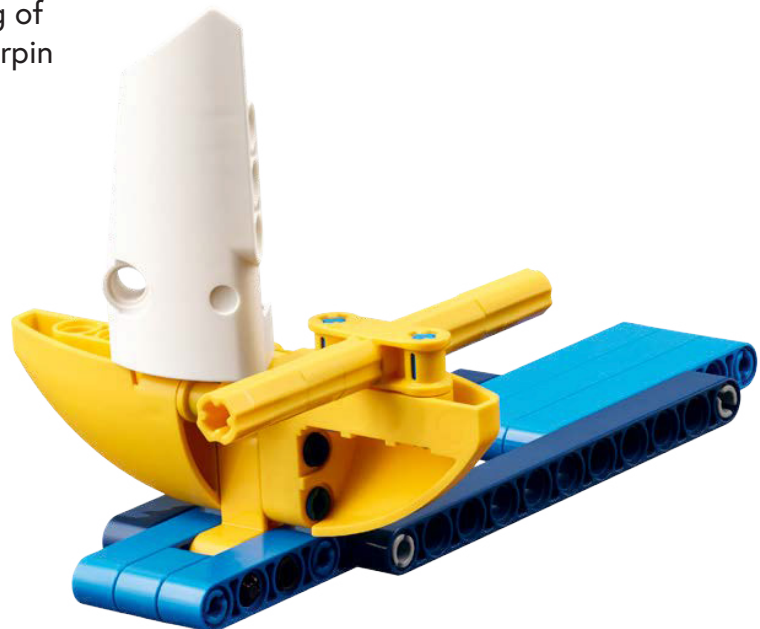
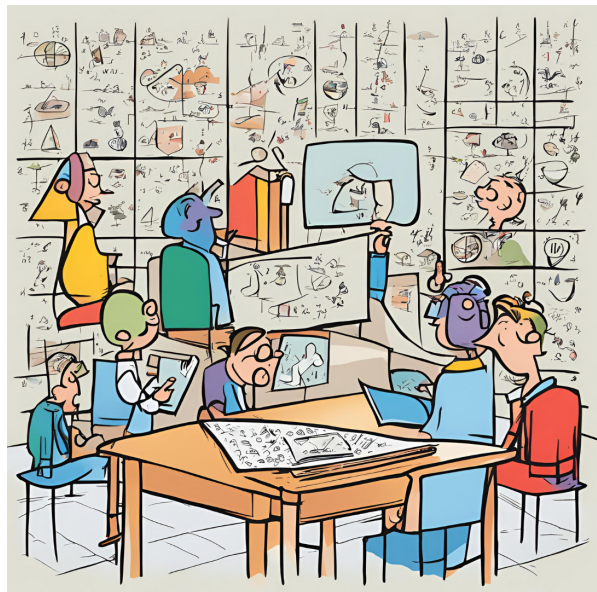
Engineering

With a focus on 'make', engineering supports the development of a functional artefact that embeds concepts of reliability, effectiveness, efficiency, and adaptability. Design and use of mechanical systems to enhance robotic function supports a practical reasoning of motion, force, and reliability, where innovation is central to design decisions. Building the design is a process of evaluation and refinement as restrictions and limitations become apparent. Learning through design and make creates opportunities to collaborate, research, and imagine, while making considered decisions on how to move forward.



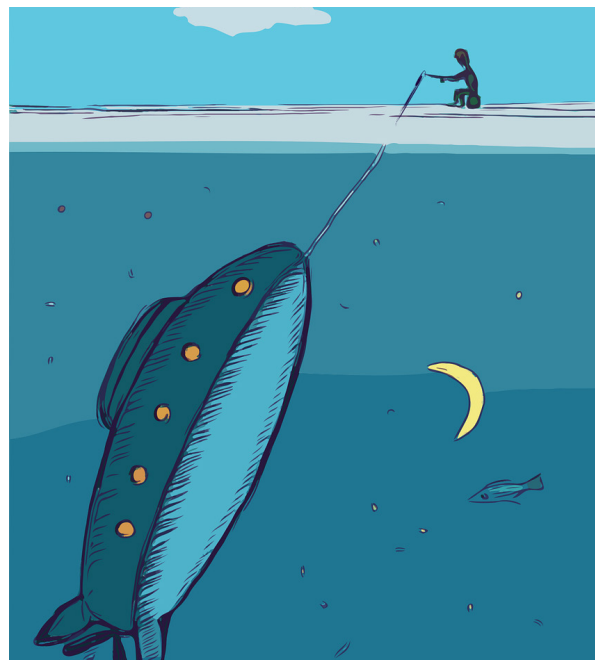
Mathematics

Student will engage with mathematical calculations, unit conversions and exploration of possible solutions through coding and physical movement and operations. The significance of being able to plan and predict potential approaches to solve specific problems is reinforced by trial-and-error testing, where mathematical capability and literacy are essential. Mathematic abstractions are realised in tangible tasks that can explore spatial, vectored, geometric, and arithmetic skills. The application of abstract concepts and principles (or even ideas) support meaningful immediate feedback when applied. This will strengthen conceptual understanding by enabling tweaking, reframing, reconceiving, and refining of the mathematical models that underpin desired functions.



Geography

Within the SUBMERGED season a specific focus is being placed on students gaining a deeper understanding of the ocean and ecosystems. The Innovation Project for this season and Robot Game align with the overarching concept of Geoliteracy. This season, teams are required to explore the physical world of the ocean, how humans interact with the ocean and challenges they face in unlocking its hidden gems, while also considering the broader factors that influence our oceans. Exploring geography in this fun way opens the door for students to consider it as a future area of study or potential career.



Coding and Computer Science

Learners explore the range of uses of computers in the world through both the Robot Game and Innovation Project aspects of the SUBMERGED season in a practical and hands-on way. Engaging in these aspects of the competition students can immerse themselves in writing code in various languages from using basic icon coding blocks to Python. Learners are responsible for writing, testing, and evaluating their unique code for the Robot Game to adapt to the requirements of a real-life setting using teamwork to address challenges that arise.



English

Communication of team solutions in Challenge opens the door for students to creatively and innovatively explore their expression of English language. Teams are encouraged to produce presentations, performances (e.g., plays and movies), create videos and experiment with alternative methods of communication to convey their journey to the judges- the more creative and innovative the better!



Global citizenship

Transition Year encourages students to become active citizens that understand social, environmental and economic issues at local, national and global levels. SUBMERGED directly aligns with this subject area and inspires students to explore the challenges faced by those trying to understand more about our ocean ecosystem and the broader potential impacts that this may have.

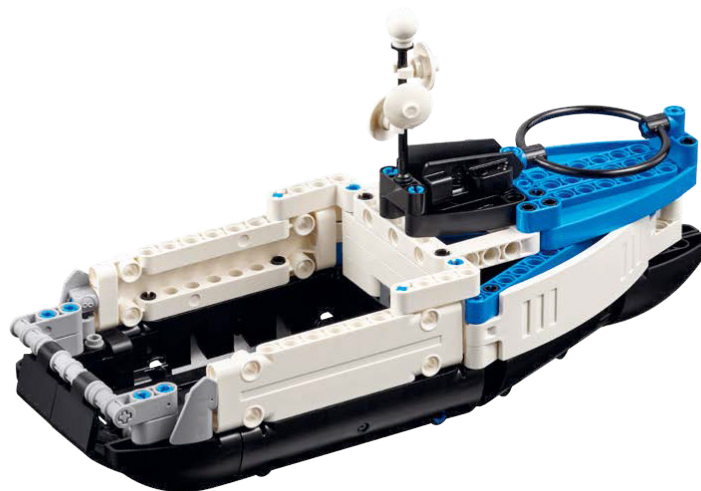
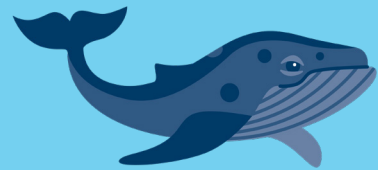


Part B

This section provides some ideas to support teachers and mentors in introducing *FIRST* LEGO League Challenge, SUBMERGED and the LEGO Education SPIKE Prime set. This section also sets out sample learning outcomes for lesson planning which supplement the Team Meeting Guide and Engineering Notebook to support teachers in integrating the programme into their lesson planning.

Introducing learners to *FIRST* LEGO League Challenge and SUBMERGED

From the first session with each team, it is important that each team documents everything as evidence of their journey as it will play a vital part of their presentation to judges at the regional competitions. It can be helpful for teams to assign roles of note takers, photographers, and videographers to include the rich evidence of their process in the final presentation. It is strongly recommended to back up all these valuable resources on a suitable platform as accidents and breakages of devices can and do happen throughout the course of the season.



Introductory sessions

Session 1 in the Engineering Notebook is the most important session for all members of the team to engage in. This session not only introduces the SUBMERGED theme but also provides critical information about the structure of the competition, the different elements that contribute to scoring and the significance that is placed on the core principles and values throughout the season. Here's a helpful video with a summary of this content before teams dive into pages 3-7 of the SUBMERGED Engineering Notebook.



Where time allows, it may be beneficial to deliver Session 1 as two separate sessions. For example, Session 1.1 may focus on the competition structure giving teams a greater chance to unpack each of the 4 main elements of the competition. This can allow time for teams to develop a plan of how they might assign or alternate roles in the team. It would also allow time for the group to consider how they will incorporate **Core Values**, **Gracious Professionalism**® and **Coopertition**®. This session would include pages 3-7, 12-13.

Session 1.2 would then focus on introducing and exploring the SUBMERGED theme by focusing specifically on the season's Innovation Project, building and placing the mission models on the mat, and exploring how the models work and connect to the Innovation Project Sparks on page 7 of the Engineering Notebook.

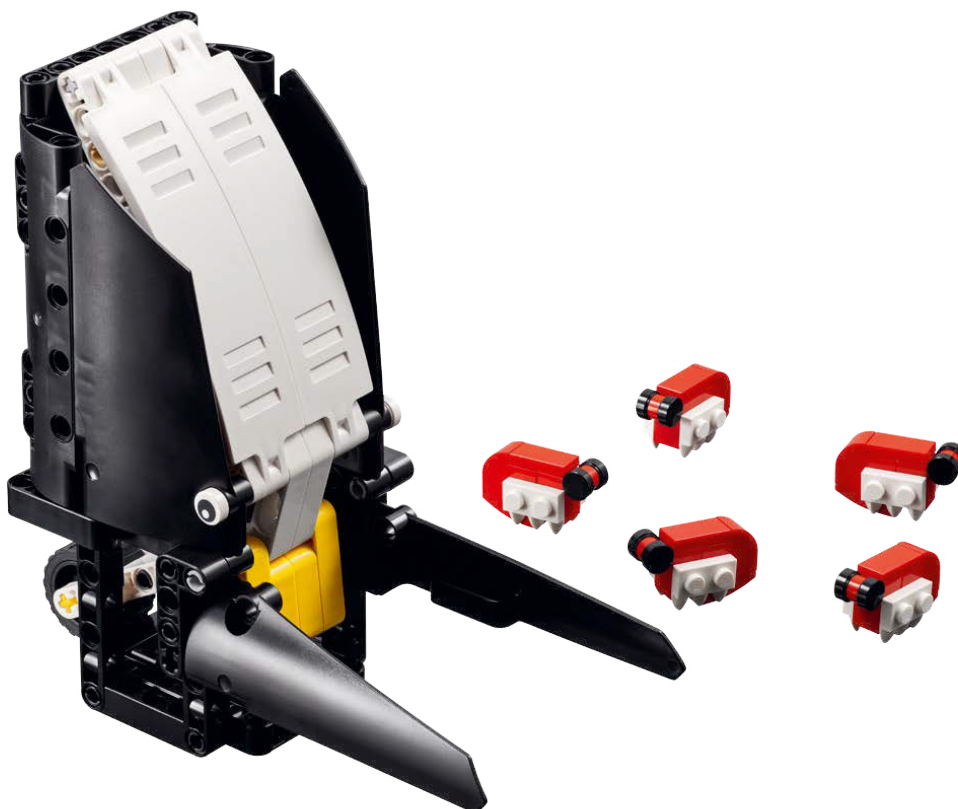
Following these two introductory sessions, teams will be well placed to take the reins and begin exploring how the SPIKE Prime robot works and kicking off their SUBMERGED season journey.

→ Introduction

- Watch the season videos and read [pages 3-11](#) to learn how **FIRST**® **LEGO**® League Challenge works and about the **SUBMERGED**™ robot game and innovation project.
- Get to know your team members and select your team name.

→ Tasks

- Dive in to the season theme by building the robot game mission models.
- Place each model where it belongs on the mat. Refer to the field setup section of the *Robot Game Rulebook*.
- Explore how the models work and how they might connect to the Project Sparks on [page 7](#).





LEGO® Education SPIKE™ App

Windows 10

LAUNCH WEB APP

BEFORE UPDATING:

Please check system requirements before updating.

System Requirements



Web App Instructions



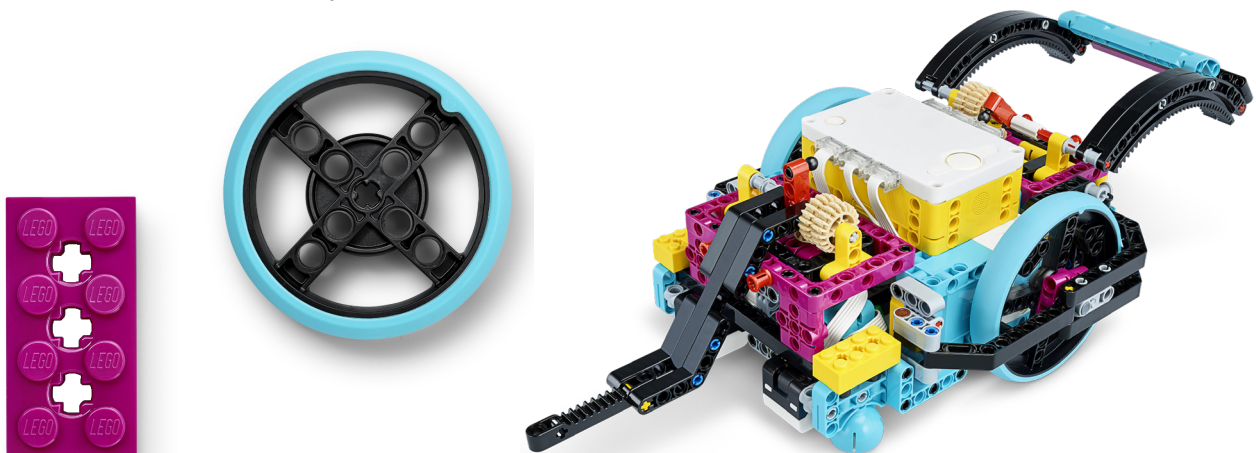
Introducing SPIKE Prime

The LEGO SPIKE Prime set is a robust and exciting pack with far reaching capabilities beyond those required in the *FIRST* LEGO League Challenge. Training is available for Teachers and Mentors on the use of the SPIKE Prime set and App at CreativeHUT and TUS at the beginning of each season.

If your school is receiving new SPIKE Prime sets, follow the instructions within these for unboxing and labelling parts. Students can get involved in this process as it will help them to familiarise themselves with where parts are located

within the kit. It is important to label the SPIKE hub within each set to ensure that they do not accidentally get mixed into another kit. Teams coding progress will be saved on their individual robot hub and on the **SPIKE App**.

Sessions 2-4 in the Engineering Notebook are Training Camps which focus on teams exploring some of the capabilities of the SPIKE hub and App. Teams should select the SPIKE section here to unlock the range of tutorials, builds, and challenges included in the App.



Select your SPIKE™ solution



SPIKE
Essential



SPIKE
Prime



Through these sessions students discover displays, motors, and sensor technologies reflecting on how their robot can:

- Move and interact with objects
- Interpret information received from sensors
- Produce motion in a direction they have specified through their coding.

Sessions 2-4 ensure that teams have a base knowledge of how their robot works and can interact with mission models. To take this a step further and embed further STEM curricular links a session may also be included, where time allows, to explore specific relevant content. For example, mechanisms play an important part in solving many of the missions and a session spent exploring these can save teams much time if facing problems later in their journey when trying to solve an engineering design issue. A mechanism of particular importance is gears. Gears are required in robots that have a lift arm to ensure that the Coder can control when

and how the lift arm operates. Important concepts for students to research in such a session would include meshing gears, gear ratios, gear types, and mechanical advantage. Below is an overview of how such a session may be implemented with QR codes to various resources to supplement the session.



Mechanism session overview

Introduction

- Review the resources below that explore mechanisms.
- See what information you can find about other mechanisms.
- Reflect on how these might be connected to the robot game and missions.

Gearing Concepts to Explore

Meshing Gears



Gear Ratios



Gear Types



Further Mechanisms to Explore

Levers



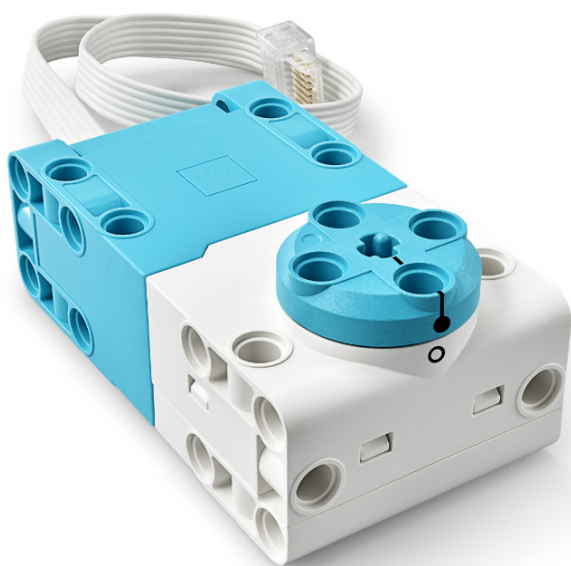
Linkages



Pulleys



Wheels and Axles



Tasks

- Experiment by building models and prototypes of the mechanisms you have been exploring.
- Attach these to your robot.
- Code your robot to control the mechanisms and observe and refine how this works.

Share

Get together at the competition table.

- Review how these mechanisms are integrated into mission models.
- Discuss the reflection questions
- Remember - it is your responsibility to clean up your space.

Reflection Questions

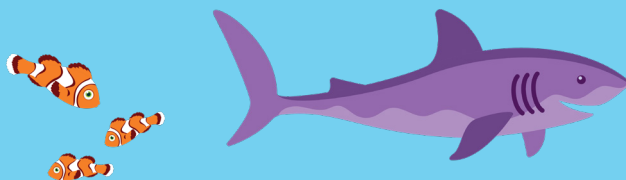
- Which mission models could I use these mechanisms to solve?
- How can I attach these to my robot?
- How did you use Discovery in this session?

Reminder Note

Think about the subjects your students have studied or are studying and the knowledge and skills that they can bring in to an integrated STEM activity!

Completion of these various introductory sessions will best prepare students for almost any issues that they may face throughout their SUBMERGED Challenge journey. As with all sessions, it is important that teams take responsibility for their learning journey in these introduction sessions to prepare themselves to progress through the challenges ahead of them. Reflections and progress/changes should be documented to contribute towards their final presentation.

To support schools and teachers to integrate SUBMERGED into their lesson planning, the following table provides sample Learning Outcomes which can be included in lesson planning to document the experiences that learners are engaging with through the course of the season.



Sample learning outcomes for sessions 1-12 of Engineering Notebook

	Focus	Sample Learning Outcome
Session 1	The SUBMERGED Theme, Innovation Project, and Building Mission Models, Sharing and reflecting	<ul style="list-style-type: none"> Describe the focus of the SUBMERGED theme Identify and describe the missions Construct the missions and locate them on the challenge board Examine the missions and details of the challenge State the rules, regulations and conditions of the challenge
Session 2	Focus on Core Value of Discovery, Tutorial activities (optional), Exploring the Robot Game, Driving a robot around, Sharing and reflecting	<ul style="list-style-type: none"> Contrast and compare the technical requirements of the various missions Assemble a simple Robot Test and Appraise basic Robot functionality Explain the operations of the Robot and predict how changes will impact the Robots functions
Session 3	Sharing Innovation Project ideas, Coding the robot to interact with objects, Sharing and reflecting	<ul style="list-style-type: none"> Propose project ideas to include specific areas of interest/innovation Iterate ideas through discussion and critique Design, develop and modify code to perform specific tasks Assess robot performance
Session 4	Narrowing down Innovation Project ideas, Using sensors to enable the robot to react to lines, Sharing and reflecting	<ul style="list-style-type: none"> Argue for more effective design idea Plan and predict the operations of the robot using sensor controls Interpret the value of sensor controls to solve the challenge
Session 5	Focus on Core Value of Teamwork, Perform a Guided robot mission, Identify the problem the Innovation Project is going to solve, Research the problem, Sharing and reflecting	<ul style="list-style-type: none"> Classify the characteristics of an effective team Organise key roles and responsibilities of all team members Test and Modify design to complete a guided mission Identify and Research a suitable innovation project Discuss the project value and impact
Session 6	Robot Game Mission strategy and scoring, Complete Pseudocode, Improving driving base design, Progress Innovation Project, Sharing and reflecting	<ul style="list-style-type: none"> Formulate an approach to maximise scores Design and create initial pseudocode Develop and construct an advanced driving base Organise Innovation project milestones and deliverables Restate challenge objectives and targets

Table 4a. Overview of sample Learning Outcomes for lesson planning for SUBMERGED Challenge.

Session 7	Focus on Gracious Professionalism®, Continue robot advancement and mission performance, Develop and create Innovation Project solution, Create a prototype, model or drawing, Sharing and reflecting	<ul style="list-style-type: none"> • Appraise evidence of Gracious Professionalism • Critique, modify, and verify robot performance • Describe and sketch innovation project solution • Create and assemble prototype solution • Appraise and qualify the value of the initial solution and prototype
Session 8	Focus on Coopertition®, Attempt new mission and discuss strategy, Iterate and refine coding, Plan how to share Innovation Project with others, Decide if feedback and testing of solution is required, Sharing and reflecting	<ul style="list-style-type: none"> • Compare, contrast, and discuss solution when performing a new mission • Diagnose performance to maximise scoring and collaboration • Assess performance through targeted testing and modifications • Organise and recommend a communication strategy, to include a variety of media and collaborations
Session 9	Focus on Innovation, Test, iterate, and improve coding and mission strategy, Share the work completed on Innovation Project and robot mat with team, Explore demonstrating Core Values to judges, Sharing and reflecting	<ul style="list-style-type: none"> • Invent a holistic approach to ensure effective and reliable performance • Restate project strategy and defend challenge solution • Identify evidence of core values and devise a plan to illustrate them • Summarise the value and contribution of all team members
Session 10	Focus on Impact, Plan presentation considering rubrics, Plan script, props and displays needed, Continue robot development and practice for 2.5 minute Robot Game, Sharing and reflecting	<ul style="list-style-type: none"> • Formulate and design team identity, outfits and swag for tournament • Examine presentation rubric and scoring system • Plan approach to presentation of innovation project • Refine robot performance through time testing and efficiency improvements • Discuss, predict, test, and modify possible areas of improvement
Session 11	Focus on Inclusion, Refine presentation, Practice presentation ensuring all team members can communicate about the design/build/etc., Run through of Robot Game, Sharing and reflecting	<ul style="list-style-type: none"> • Compose final presentation to include meaningful participation of all team members • Produce Robot for final test run • Recommend final modifications (tweaks) • Manage final details to ensure all details are included as per challenge requirements
Session 12	Reflect on Fun had while engaging in SUBMERGED, Rehearse presentation, Demonstrate Core Values, Practice runs of Robot Game, Prepare for regionals, Sharing and reflecting	<ul style="list-style-type: none"> • Describe the knowledge, skills, and experience gained • Restate evidence of core values • Prepare final plan and challenge solutions for regional competition • Report on experience of FLL

Table 4b. Overview of sample Learning Outcomes for lesson planning for SUBMERGED Challenge.

Part C

Integrating *FIRST* LEGO League Challenge into the Irish Post Primary curriculum

There are various approaches through which the SUBMERGED Challenge may be integrated into post-primary education. The flexibility of students' engagement with the 12 sessions set out in the Team Meeting Guide (for teachers) and Engineering Notebook (for students) means that the sessions can be adapted to suit availability of resources and schedules of schools and students.



Junior Cycle

Challenge could be integrated into existing subjects such as Coding or Applied Technology or different elements may be delivered in different subject areas. For example, the Innovation Project exploring the ocean ecosystem could be explored in Geography lessons, while the Robot Design be a focus of Applied Technology/Engineering, and the Robot Game could be integrated into Coding. However, this may present a few logistical challenges depending on the individual school. It may, therefore, be

most suitable to incorporate Challenge into one subject area with the opportunity to have expert visits from teachers in the relevant subject areas to facilitate teams in progressing with their ideas.

Sample schedules of delivery in courses and short courses are outlined in the following section providing an overview of time allocations, competition focus areas and activities for learners to engage with in the Team Meeting Guide (for teacher/mentor/facilitator) and Engineering Notebook (for students).



Transition Year

The focus of Transition Year is to ensure that students get to experience new things that they may not have the opportunity to in the other years of their formal education. Challenge presents an opportunity for students to assume greater autonomy for their learning in a fun, exciting, and competitive way. Challenge also affords the opportunity for students to engage in integrated STEM learning experiences in an immersive and applied manner. *FIRST LEGO League Challenge* could be integrated as a Transition Unit (45 hours) or as a micro modules structure for students.



Alternatively, there is an opportunity to host internal Robot Game days, whereby all students can try out an element of the competition and be selected as the school representatives to compete at regional tournaments.

Sample schedules of delivery in Transition Units and Micro Modules are outlined in the following section providing an overview of time allocations, competition focus areas and activities for learners to engage with in the Team Meeting Guide (for teacher/mentor/facilitator) and Engineering Notebook (for students).

Lunch/after school clubs

It can sometimes be difficult to integrate *FIRST LEGO League Challenge* into class time for a variety of reasons and logistical challenges. Therefore, lunch and after school LEGO clubs have become a popular mechanism to afford students the opportunity to engage in the competition. As with engagement in class time, during lunch and after school clubs the role of the supervisor is to act as a facilitator ensuring that the learner has access to the resources required. In some instances, schools who have senior students that have participated in Challenge in previous years welcome these students back to lunch and after school clubs to act as peer mentors to encourage younger students along their journey.

As time is limited in these club settings, an overview is provided in the table below

for how the Challenge programme could be completed in an accelerated time frame. The accelerated programme is also suitable for schools who have registered late for the competition.

The accelerated programme involves splitting teams into two groups to tackle separate elements of Challenge e.g., Robot Design and Game, and Innovation Project. It is important that in this format, groups share information regularly to ensure a cohesive presentation to judges at regional competitions. Where lunch and after school clubs have a greater number of sessions available to them, the previous 12 and 8 session plans outlined above may be adapted and delivered in a two-group format.

Integrated Junior Cycle course/Transition unit schedule for delivery

FIRST LEGO League Challenge - Standard Session Plan: 12 x 2 to 2½ hours (see also Team Meeting Guide, page 8)

This is an overview of the recommended 12-session programme. Teams are free to adapt their schedule to fit the number and duration of sessions available to them. For teams with less time available for each session, the IET provides a suggested quick route, requiring 12 x 1-hour sessions:

<https://education.theiet.org/first-lego-league-programmes/quick-routes-for-the-current-season/challenge-quick-route>

	Core Values (10-15 mins) Integrated throughout each session	Robot Design and Robot Game (50-60 minutes)	Innovation Project (50-60 minutes)	Share (10-15 minutes)
Session 1	Introduction Team Meeting Guide (TMG) page 10 Engineering Notebook (EN) page 14	Build Mission Models TMG page 10 EN page 14	Marine Biologist TMG page 10 EN page 7, 14	Share TMG page 10 EN page 14
Session 2	Goals and Processes TMG page 4, 5 EN page 3-6	App: Training Camp 1 Driving Around TMG page 11 EN page 15	Submarine Pilot TMG page 11 EN page 7, 15	Share TMG page 11 EN page 15
Session 3	Team Design TMG page 4, 5 EN page 13	App: Training Camp 2 Playing with Objects TMG page 12 EN page 16	Oceanographer TMG page 12 EN page 7, 16	Share TMG page 12 EN page 16
Session 4	Core Value: Discovery TMG page 11 EN page 15	App: Training Camp 3 Reacting to Lines TMG page 12 EN page 17	Ecologist TMG page 13 EN page 7, 17	Share TMG page 13 EN page 17
Session 5	Core Value: Teamwork TMG page 16 EN page 18	App: Guided Mission TMG page 16 EN page 18	Identify problem to solve TMG page 17 EN page 19	Share TMG page 17 EN page 19

	Core Values (10-15 mins) Integrated throughout each session	Robot Design and Robot Game (50-60 minutes)	Innovation Project (50-60 minutes)	Share (10-15 minutes)
Session 6	Review Progress TMG page 18 EN page 20	Strategy, first missions, pseudocode TMG page 18 EN page 20, 22	Research problem, identify solution TMG page 19 EN page 21, 25	Share TMG page 19 EN page 21
Session 7	Gracious Professionalism® TMG page 20 EN page 24	Design, build, code, test robot to solve missions TMG page 20 EN page 24	Develop project solution TMG page 21 EN page 25	Share TMG page 21 EN page 25
Session 8	Cooperation® TMG page 22 EN page 26	Design, build, code, test robot to solve missions TMG page 22 EN page 26	Evaluate and test solution TMG page 23 EN page 27	Share TMG page 23 EN page 27
Session 9	Core Value: Innovation TMG page 26 EN page 28	Test, iterate, improve robot, additional missions TMG page 26 EN page 28	Test, iterate, improve project solution TMG page 26 EN page 28	Share TMG page 26 EN page 28
Session 10	Core Value: Impact TMG page 27 EN page 29	Test, iterate, improve robot, additional missions TMG page 27 EN page 29	Prepare project presentation TMG page 27 EN page 29	Share TMG page 27 EN page 29
Session 11	Core Value: Inclusion TMG page 28 EN page 30	Prepare robot design presentation, game plan TMG page 28 EN page 30	Iterate on project presentation TMG page 28 EN page 30	Share TMG page 28 EN page 30
Session 12	Core Value: Fun TMG page 29 EN page 31	Practice robot game TMG page 29 EN page 31	Rehearse presentation TMG page 29 EN page 31	Share TMG page 29 EN page 31

Table 5. Integrated Junior Cycle course/Transition unit schedule for delivery of SUBMERGED Challenge.

Short course/micro module schedule for delivery

FIRST LEGO League Challenge - Accelerated Session Plan: 8 x 2 hours (This plan requires the Mission Models to be built in advance)

This is an overview of an accelerated 8-session programme, covering essentially the same content as the Standard Session Plan in a shorter timeframe. Teams are free to adapt their schedule to fit the number and duration of sessions available to them.

	Core Values (10 mins) Integrated throughout each session	Robot Design and Robot Game (50 minutes)	Innovation Project (50 minutes)	Share (10 minutes)
Session 1	Introduction and Goals Team Meeting Guide (TMG) page 4, 5, 10 Engineering Notebook (EN) page 4, 5, 14	App: Tutorials and Training Camp 1 TMG page 11 EN page 15	Mission Models and Project Sparks TMG page 10 EN page 7, 8-11, 14	Share
Session 2	Core Value: Discovery TMG page 11 EN page 15	App: Training Camp 2 TMG page 12 EN page 16	Identify problem to solve TMG page 17 EN page 19	Share
Session 3	Core Value: Teamwork TMG page 16 EN page 18	App: Training Camp 3 and Guided Mission TMG page 13, 16 EN page 17, 18	Research problem, develop solution TMG page 19, 21 EN page 21, 25	Share
Session 4	Core Value: Innovation TMG page 26 EN page 28	Strategy, first missions, pseudocode TMG page 18 EN page 20, 22	Solution testing and evaluation TMG page 23 EN page 27	Share
Session 5	Core Value: Impact TMG page 27 EN page 29	Design, build, code, test robot to solve missions TMG page 20, 22 EN page 24, 26	Test, iterate, improve project solution TMG page 26 EN page 28	Share
Session 6	Core Value: Inclusion TMG page 28 EN page 30	Test, iterate, improve robot, additional missions TMG page 26 EN page 28	Prepare project presentation TMG page 27 EN page 29	Share
Session 7	Core Value: Fun TMG page 29 EN page 31	Prepare design presentation, test game plan TMG page 28 EN page 30	Iterate on project presentation TMG page 28 EN page 30	Share
Session 8	Gracious Professionalism® and Coopertition® TMG page 20, 22 EN page 24, 26	Practice robot game TMG page 29 EN page 31	Rehearse full presentation TMG page 39 EN page 31	Share

Table 6. Short course/micro module schedule for delivery of SUBMERGED Challenge.

Lunch/after school club schedule for delivery

FIRST LEGO League Challenge - Sprint Session Plan: 6 x 1 hours (This plan requires the Mission Models to be built in advance)

	Group 1	Group 2
	<i>It is recommended to swap the group roles to ensure everyone has a chance to experience all elements of FIRST LEGO League Challenge</i>	
	Core Values (10 mins) Integrated throughout each session	Robot Design and Robot Game (50 minutes)
Session 1	Introduction and Goals Team Meeting Guide (TMG) page 4, 5, 10 Engineering Notebook (EN) page 4, 5, 14	SPIKE: Tutorials, Training Camp 1 TMG page 11 EN page 15
Session 2	Core Values: Discovery and Teamwork TMG page 11, 16 EN page 15, 18	SPIKE: Training Camp 2, Game Strategy TMG page 12, 18 EN page 16, 20, 22
Session 3	Core Values: Innovation and Impact TMG page 26, 27 EN page 28, 29	Code and test robot TMG page 16, 20 EN page 18, 24
Session 4	Core Values: Inclusion and Fun TMG page 28, 29 EN page 30, 31	Test, iterate, improve robot TMG page 22, 26 EN page 26, 28
Session 5	Gracious Professionalism® and Coopertition® TMG page 20, 22 EN page 24, 26	Prepare design presentation, test game plan TMG page 28 EN page 30
Session 6	Reflect on Core Values in action, review Core Values rubrics TMG page 29 EN page 31	Practice robot game, review Robot Design rubrics TMG page 30, 31 EN page 32, 33

Table 7. Lunch/after school club schedule for delivery of SUBMERGED Challenge.

Useful tips for delivery in schools

It can be difficult and overwhelming to know where to start when preparing to integrate a new initiative or programme into post-primary schools. The following tips and tricks serve to supplement the recommendations in the Team Meeting Guide for team mentors to support teachers in overcoming some common pitfalls or challenges.

The role of the Teacher/Mentor

It is natural to want to help students. It is important to remember that the focus of *FIRST LEGO League Challenge* is that young people take ownership of their experience to ensure they get the most from it. The role of the Teacher/Mentor is to facilitate, encourage, and equip the students with the resources necessary for them to take complete ownership of their *SUBMERGED* experience.

The importance of dedicated time to sharing progress

Time should be allowed and encouraged at the beginning and end of session for the groups to share their progress with one another which will not only give a clear picture of what they need to do to progress but will also contribute towards the Core Values element of *FIRST LEGO League Challenge*. This will help them in the judging room at regionals when they are asked about their Teamwork, Inclusion etc. which accounts for 25% of the team's overall score!



Selection and Organisation of teams

Teams of up to 10 members can participate in *FIRST LEGO League Challenge*. Where whole class/club groups will not be participating in Challenge for the full duration of the season, there are several ways to select teams. In some schools, students are allowed to self-select to participate. Other schools prefer to have all students try out the season's Challenge and participate in an internal 1-day school blitz competition (which can be facilitated by TUS or CreativeHUT depending on geographic location). In this format, groups spend an intensive day considering the theme of the season and Robot Game where the winners of the blitz competition then go forward to represent the school. This format has proven particularly popular at Transition Year level.

Once teams are selected it can be valuable to alternate the role of sub-groups within the team to ensure that everyone gets an opportunity to experience all elements of *FIRST LEGO League Challenge*. Team members do tend to gravitate towards certain roles i.e., assume the role of innovators or robot designers. Teams should be encouraged in the first couple of sessions to try their hand at each of the project roles as they might just surprise themselves at how much they enjoy coding, building, designing, and/or innovating!



Engaging with professionals

It can be quite valuable, particularly to a team's Innovation Project, to engage with professionals relating to the season's theme. Within the Engineering Notebook (pages 6 and 7) there is a Career Connections page which provides an overview and links to resources of challenges that some professionals experience relating to the SUBMERGED theme. This can prove as a helpful starting point in identifying a problem to solve.

In developing Innovation Project solutions, teams may also wish to consult with experts in these fields e.g., engineering, technology, bio-science etc. In many instances a team member may have a connection to a relevant expert e.g., a parent, relative or family friend. Where there is not a connection with relevant experts, support is available through TUS to identify experts and connect them with schools. This may take place in person through an on-site visit or online through a video call. Teams are also free to contact companies/professionals that they identify themselves.

Managing equipment

The correct management of equipment is essential to ensuring that teams can get the most out of each session that they attend. Some helpful tips for Teachers, Mentors and teams for managing kit:

- Assign each team a SPIKE Prime kit/box number that they will assume responsibility for the duration of the season and keep a record of this.
- Each Kit contains a sheet with an overview of the parts that are contained within it. Teams should use this as a reference point to ensure all parts are present at the beginning and end of a session. Teachers/mentors should spot check this from time-to-time.
- Move all school bags to a nominated space in the room to ensure no parts accidentally fall in!
- Teams should nominate a member/s that are responsible for ensuring that the SPIKE hub is charged for sessions and competitions.
- Remember to allocate time for tidy up! Small parts and records of progress are easily lost in a rush to the next class or home.



Most Importantly

Enjoy your *FIRST* LEGO League Challenge SUBMERGED journey!



Resources

There is a host of resources available for the SUBMERGED season on the CreativeHUT website.

CreativeHUT



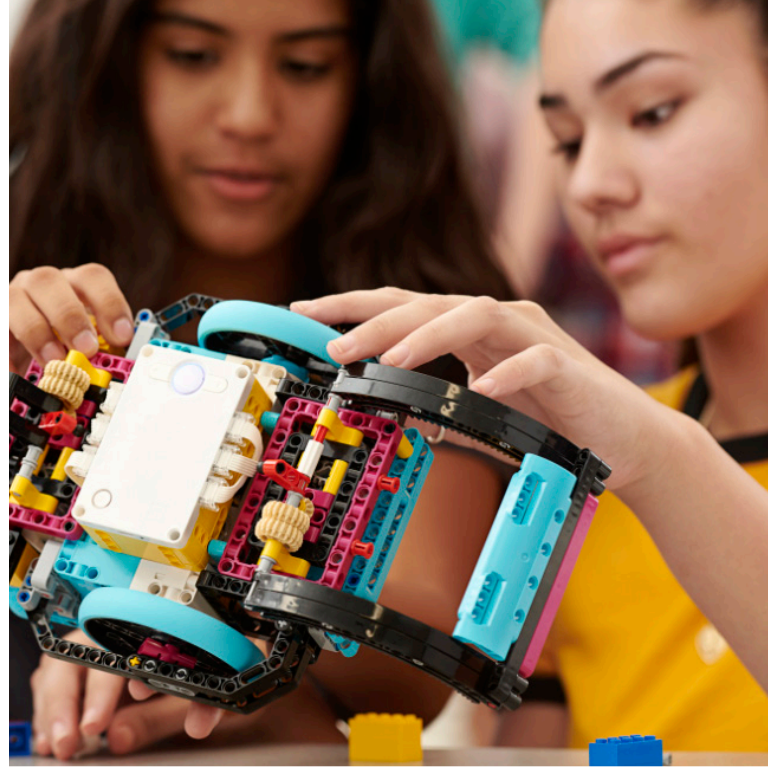
LEGO SPIKE App



References

References





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